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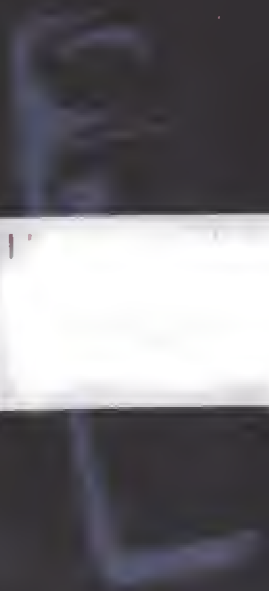

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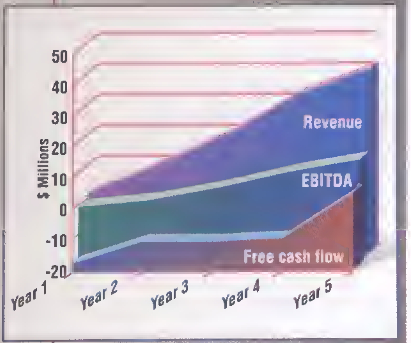

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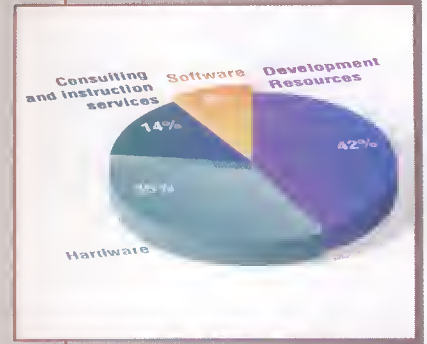

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Our cover story separates CDMA fact from fiction, and begins on Page 22.
Cover illustration by Jon Fraze

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CHARLES MASON

Let's move on

Having covered the wireless industry for the past decade, I've watched the evolution of The Great Air Interface Debate with a lot of interest.

I've had the opportunity to use all of the technologies, from field-trial stage to when they were commercially deployed. As a Sprint subscriber, I use CDMA on a daily basis at home in Seattle, as well as when traveling in other cities.

I have witnessed careers placed on the chopping block in defense of an air interface technology. I also have seen healthy debate, where intelligent men and women rationally differ. GSM, IS-136 and CDMA all work; they just work differently. Each has its place, depending on a carrier's needs.

I've also seen much innuendo and back-stabbing. Few companies have come under more attacks than Qualcomm Inc. Given some of the comments I've heard over the years, you'd think the company was part of a grand conspiracy to undermine motherhood.

One would assume that after about 10 years of this, something would give. Something has. IS-95, or cdmaONE as it's now called, is alive and well, offering customers reliable service in dozens of markets. It gives carriers a chance to offer quality voice services today and enhancements tomorrow. The technology will allow them to grow their businesses. CDMA is not perfect; vendors and carriers alike have encountered problems. But it works.

Sadly, the air interface wars have distracted the wireless industry from much more important issues, such as Where do we go from here? What are tomorrow's enhanced services and how will we make them possible? The sniping and back-biting over RF interfaces have become counterproductive.

"Over the longer term, industry challenges are not about RF issues. They are not about specific RF standards. They are about adding value," says Jane Zweig, senior vice president at Herschel Shosteck Associates Ltd.

Zwieg notes that the focus must shift away from hierarchical to distributed network architectures—from hardware- to software-based functionality. It must shift to the types of services that can drive demand and, ultimately, profits. It must shift to an open software platform that will cross all wireless business units. Infrastructure vendors must consider alliances with software giants, such as Microsoft and Sun.

These are but a few of the key issues facing the wireless industry. As difficult as it is for the critics and competitors to accept, CDMA works. Now, let's debate the future—not the past.

Charles Mason

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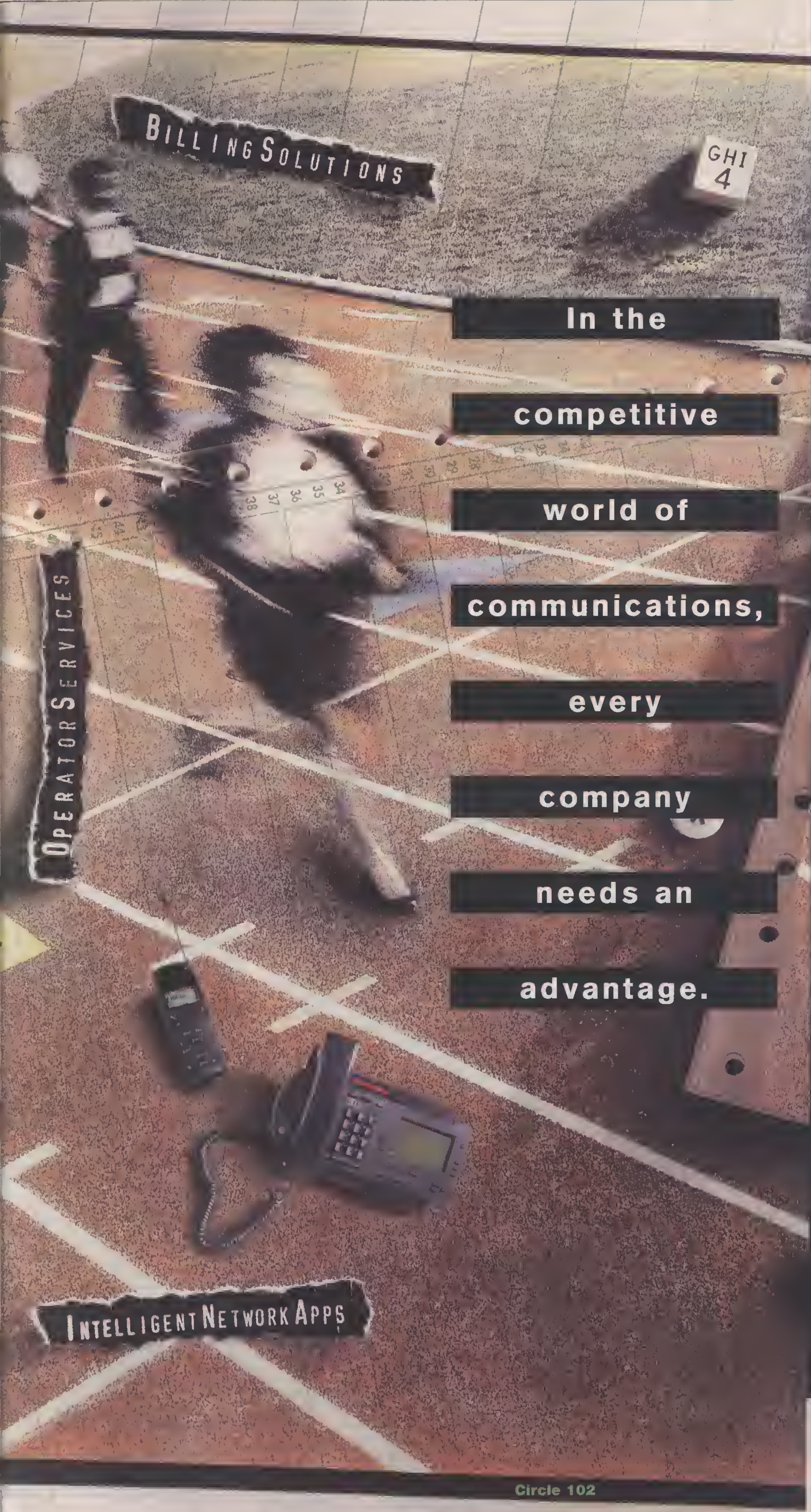
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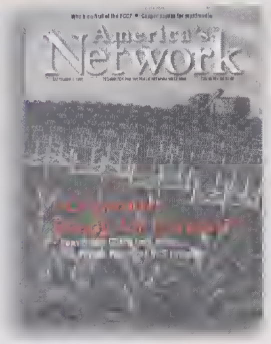
ALOHA FROM HAWAII



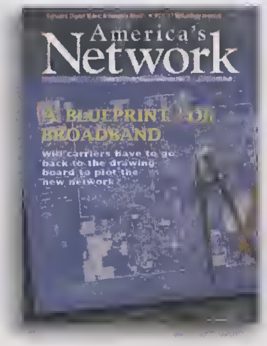
I enjoyed the article about Hawaii ("Last Call," Sept. 1) and all of the others written by Art Brothers. A note on Hawaii: If you discipline a worker for messing up, he can file a worker's compensation claim for the stress it caused him.

Tell the Federal Communications Commission that the interstate subscriber line charge ($6.25 on my local business phone bill from GTE) should be optional if you choose not to make or receive long distance calls on that line. It could save money for all of us with more than one line.

Did you know that the Hawaii Public Utilities Commission removed GTE from serving a district (Kau) of the Big Island, due to poor service? A company from Alaska is taking it over. I think GTE is still appealing in the courts.

Mark "Doc" Goldman
Communication Center of Hawaii
Hilo, Hawaii

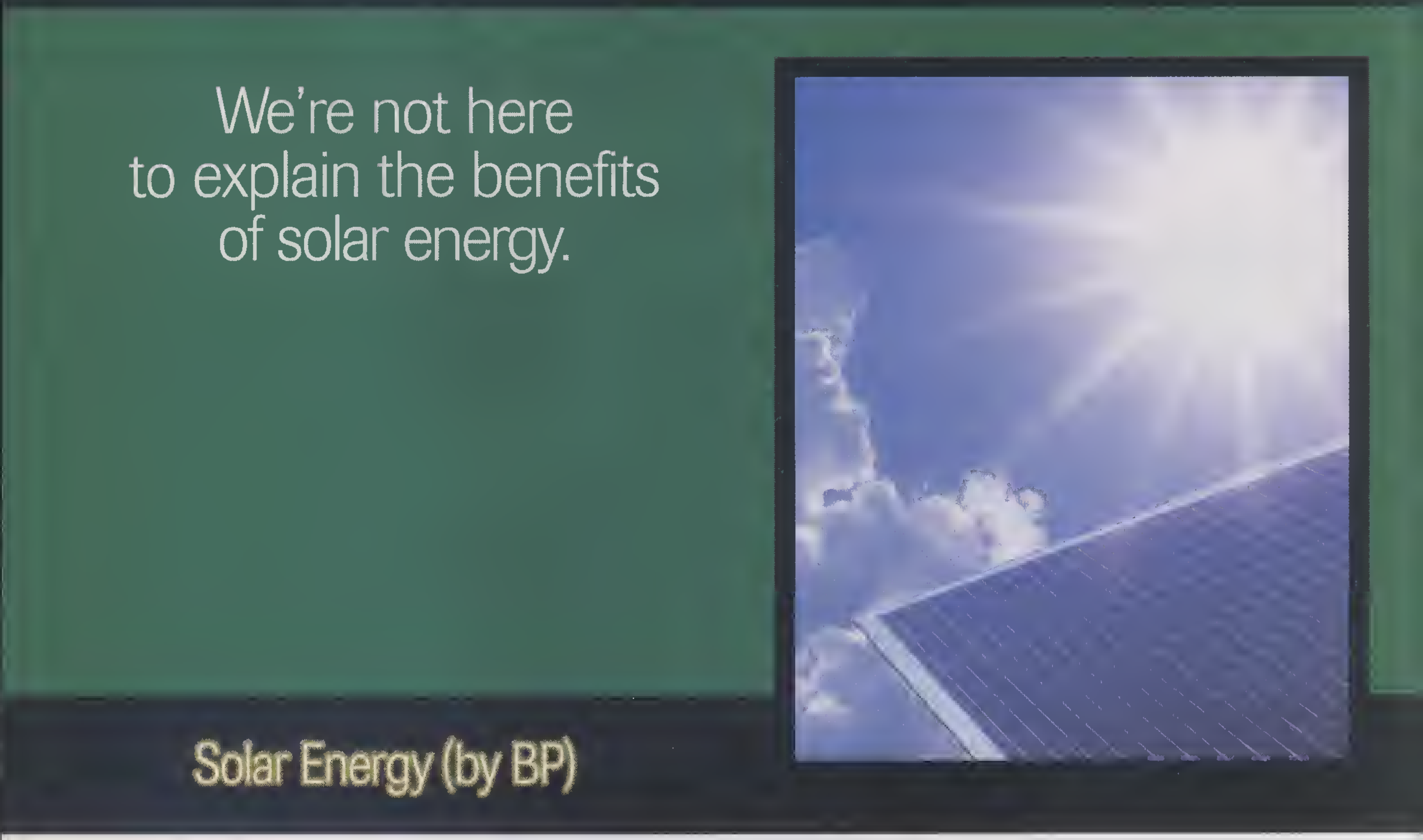
GET ON WITH THE BUSINESS


America's Network
A BLUEPRINT FOR BROADBAND
Will carriers have to go back to the drawing board to plot the new network?

"For want of a nail, the shoe is lost." A former employer's favorite expression was, "We justify our existence in the marketplace by adding value to the transaction." The switch seller and the consultant exist solely to ensure that the customer's requirements are met on-time, despite the obstacles.

Gary Holtmeir's experience with Sprint/United Telephone Co. versus Cincinnati Bell ("In-Box," Oct. 1) was regrettable. Gary has never had to deal with Nynex nor any other company on a bad day: try three weeks to a month to repair a data circuit or eight months to cut PBX tie lines. We all have horror stories. If it was easy, anyone could do it. Customers hire vendors and consultants for only one reason—they can't do it themselves.

By virtue of our experience, knowledge and work habits, projects are painlessly completed. It is not because everyone delivers the first time they are asked, but because the monitoring process ensures a smooth cutover, or the completion of any other task, for that matter. The most overworked word today is *paradigm*. Change is the order of the day. As the vendor or consultant, it is your responsibility to get what you need, when you need it. You must give the supplier a reasonable time period in which to perform. It's nice that Cincinnati Bell does a good



job, but what about when it doesn't? Unless you stay on top of every detail, the cut will go sour. Gary's case studies are a learning experience.

I work with Sprint/United Telephone Co. in New Jersey. I am told it has two organizations—the regulated carrier and the non-regulated sales company. The person proposing the private branch exchange should not be provisioning Centrex. Our first assigned sales rep was unresponsive.

Remember, the object is to complete the task. In every organization there is a boss. Find the boss and present your case. Our sales rep was replaced and the project is moving along nicely.

In Gary's case, find the boss and solve the challenge. It is not enough to order the provisioning of circuits. Long before the due date, there should be a meeting with the installer at the site. The location of the demarc should be clearly established and the reach numbers for field forces supervisor should be one of the first orders of business. The project record should include the order number, date, contact and commitment. If you want a written record, there is a boss that can get you one and shape up the person taking the order.

A switch installation must be tested before cutover. I want at least a week of testing before the cut—that means that the Primary Rate Interface circuits, T1 pipes and analog trunks must be operational at least a week before the cutover. Only at your own peril and the jeopardy of the customer's business do you wait until cutover weekend to have the circuits installed. If the switch was moved from another location, you still want the circuits in place and tested in your presence by the carrier. If you sell switches, your organization must have all the circuit test sets needed to test every type of circuit. At today's lower prices, if you can't afford to buy the test gear, rent it when you need it or find another business to be in.

Customer service demands outstrip all carriers' ability to provide rates. Often, carrier services are offered on an individual case basis until tariffs can be filed. I keep tariff records for all the companies we work with. If it isn't in the book, then contact the Local Exchange Carrier.

Back to the Sprint/United project; I needed a T3 rate. The LEC didn't have one filed, so it took a couple of weeks to get it. I did not need the information on the day I asked for it. I planned ahead.

A whole class of Americans are being weaned from the public trough and required to assume a role in their own welfare. We need to remind ourselves what service is about, and get about the business of providing it, without excuse.

Stuart W. Underwood
President
Paraklesis Consulting Group
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Circle # 103

Observation Deck

BILL WALL

Three HFC hurdles

Software interfaces open doors, pose challenges.

The New York Times recently quoted Fred Moran, who follows cable for Furman Selz, an institutional broker and investment banker, as saying that Microsoft's interest in cable shows that "the cable infrastructure is now the medium of choice for Internet access to the consumer user."

An HFC-based video-Internet service calls for a home terminal combining digital set-top functions and network computer features.

Microsoft's stamp of approval is interesting, but many industry observers have long known that hybrid fiber-coax (HFC) networks are the most practical means for delivering both data and video to homes. HFC seamlessly combines high-speed 'Net access with entertainment-quality video—and eventually, video on demand. Also, HFC is the only access network that supports a full range of both analog and digital services; has high bandwidth, flexibility and reliability; and can be cost-effectively migrated from one-way to two-way transmission.

CableLab's OpenCable initiative is on the verge of removing one of the industry's last remaining obstacles to deployment of digital services: standards for application software interfaces. The resolution of this issue opens the door to considerable opportunities for HFC network operators—and poses three challenges, all of which have solutions.

CREATING A LOCAL AREA NETWORK

An HFC-based video-Internet service calls for a home terminal combining digital set-top functions and network computer features—a "set-top computer." In addition to delivering high-quality digital video, set-top computers offer real-time, two-way communications, so users can surf the Web and execute network-resident applications. Individual addressing within each set-top allows high-speed, two-way communications to each terminal. With efficient upstream protocols, the two-way capabilities of the plant can rapidly deliver messages upstream.

Equipped with these set-top computers, the HFC network functions like a standard local area network (LAN). In fact, HFC can use existing LAN and Internet protocols to identify each set-top computer and route messages to them using standard routers and protocol stacks. Personnel trained in LAN technology can configure and manage the networks, which easily can be connected to external wide area networks (WANs) as well as the Internet.

MOVING APPS TO THE NETWORK

The first wave of digital set-tops to be deployed is broadcast-only set-tops. They assume every service carried within a motion picture experts group (MPEG) transmission is either a video service or an audio service. These set-tops, however, face early obsolescence.

In contrast, the new set-top computers associate an application program with every service. While small applications will be resident in the set-top, more advanced applications, such as games or Web browsing, will be resident on the network and broadcast via a data carousel. When a user requests network service, the set-top computer downloads the application program and launches it. A conditional access system for security provides both user privacy on the network as well as control of network applications by the system operator.

CONTROLLING COSTS

In terms of cost per home passed, HFC is the lowest cost network architecture available. As broadband media services are deployed, HFC is truly a pay-as-you-go architecture that matches infrastructure investment with new revenue potential, operational savings and reliability enhancements.

The network can be deployed incrementally, starting with the components for broadcast video and audio, and moving to introducing Web access and a full range of video services. Thusly, equipment obsolescence is reduced and the installed base of home terminals is ready for all services from the outset. To reduce the operational costs, operators can adopt modern network management tools to pinpoint system degradation early enough to perform preemptive maintenance.

Clearly, the television is likely to remain the home entertainment center—and two-way HFC networks let television accommodate new and traditional forms of entertainment—without extraordinary costs. To do that, operators need to use advanced digital set-tops to deliver capabilities similar to LANs. To control costs, operators must exploit the inherent flexibility of HFC, augmented with modern network management tools. ■

Bill Wall is chief scientist of Subscriber Systems for Scientific-Atlanta Inc. (Norcross, Ga.).

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EARL W. PHILMON, ROBERT P. KISSELL AND CHRIS JANSON

Why CLECs should build their own

Constructing competitive networks to serve urban residential customers can generate impressive annual returns.

Since the Telecommunications Act of 1996 was passed, competitive local exchange carriers (CLECs) have employed numerous strategies to enter new markets. The issues associated with interconnection, resale and unbundling have resulted in countless delays and regulatory roadblocks, and caused many carriers to begin building competitive networks.While this activity has occurred predominantly within the business market, the case can be made for carriers to build out competitive networks to serve residential customers in densely populated, metropolitan areas. Such a strategy can generate annual returns of 20% for these carriers.

MARKET SATURATION

For more than a decade, CLECs and competitive access providers (CAPs) have sought the high margins associated with commercial accounts by building relatively small, specialized networks to serve medium- and large-sized business customers. In doing so, these carriers have captured a portion of the special access services market from incumbent local exchange carriers (ILECs). Some cities now have four or five competitive carriers marketing services not only against the ILEC but against each other.

With such market saturation, CLECs are seeking opportunities to expand their operations. One option is to maintain their business focus and expand into smaller cities; carriers such as Brooks Fiber Properties Inc (St. Loius, Mo.) and McLeod USA (Cedar Rapids, Iowa) have distinguished themselves this way. Another option is to extend their networks in high-density areas to serve residential consumers in multi-dwelling units; RCN Corp. (Princeton, N.J.), GE-ResCom, and Optel Inc.(Dallas) have been the earliest to implement this strategy.

While many carriers use resale or unbundle services from an ILEC's network to offer competitive residential services, they should consider a facilities-based strategy, where a carrier owns the network from the central office (CO) to the customer premises. Here, a carrier can exploit the latest technology and construct a network focused on a specific customer base. It can focus on dense, lucrative service areas for deployment. A competitive network capable of carrying multiple services can be the key differentiator that empowers a CLEC to "leapfrog" its competitor.

A new network gives the competitive carrier control of its destiny. It can set pricing, service mix, and service quality at desired levels, and can distinguish its services from others. The business case for facilities-based competition offers higher revenue potential, margins and rate of return than for nonfacilities-based strategies.

THE MODEL FOR RESIDENTIAL SERVICE

To demonstrate the viability of building a network to serve primarily residential customers, a business case was developed for the CLEC structure. In addition to revenue, the model captured the cost of goods sold; selling; general and administrative expenses; capital expenses for network buildout; and associated interest expenses and taxes.

Various factors were considered in evaluating the strength of the financial model over 10 years. Among them were earnings before interest, taxes, depreciation and amortization (EBITDA)—a standard value that measures the effectiveness of a company's operating performance. CLECs and cable companies use EBITDA margins as a financial benchmark because of the capital-intensive nature of infrastructure buildout. Alternative measurements used to capture the results of the model after capital expenses include free cash flow or cash remaining for the CLEC after operations, and the internal rate of return (IRR) on the investment.

Capital expenses were assumed to be entirely debt-financed, using 12% for cost of capital. The resulting interest payments, assuming a 10-year rolling line of credit, are significant and could be avoided using an alternative financing arrangement. CLECs receive financing through a number of alternative sources, offsetting the need for this substantial debt.

Numerous assumptions were made concerning customer takes, expenses, revenues and network utilization; these were based on industry averages and were intended to err on the conservative side. The results of the analysis were compared to the financial results of companies building competitive networks for validation.

A suburban community of 150,000 homes passed is used to base the business case. This community would have a density factor of roughly 120 homes per street mile. Densities affect the economics of a network deployment, but generally any community of greater density likely will realize a lower network cost per subscriber. Many factors such as make-ready cost, franchise fees and right-of-way expenses affect the business case. The model makes assumptions relative to all of these basic business entry expenses.

Obviously, the number of customers served also plays a vital role in determining the economics of the venture. Several model parameters have been assumed to complete the customer profile expected by the CLEC. Figure 1 illustrates the take rates expected at the end of a 10-year presence in the market. Experience in commercial markets shows that these take rates for telephony and data are achievable. In areas where multiple cable TV (CATV) operators have vied for a common market, they often share the market nearly equally; this model estimates figures well below industry expectations.

The effect of customer churn on operating expenses is built in by keeping selling expenses relatively high throughout the life of the model. It assumes that not only would the carrier win new customers as services are introduced, but the challenger also will lose some customers as competition heightens. The magnitude of churn could be reduced greatly as a result of providing bundled offerings comprising telephony, data and video services.

Figure 1: Consumer take rates

Service	Peak take rate *Residential*	*Commercial*
Video	25%	N/A
Telephony	20%	15%
High speed data	10%	10%

Revenue assumptions

Video	
Revenue.	$15 for basic service $25 for standard service $40 for premium service $4 for each pay-per-view selection
Cost of goods:	20% to 45% of revenue for each service (tier-dependent)
Set-top box lease:	Required at premium service level. First unit is free; additional units $3 each
Data	
Revenue:	$35 for residential Internet $55 for remote local area network $55 for business Internet $10 per month for network interface card
Cost of goods:	45% of revenue
Voice	
Revenue:	Residential: $20 for POTS line, $5 for toll*, $25 for long distance Business: $35 for POTS line, $10 for toll*, $50 for long distance **Carrier takes 30% of toll and long distance revenue for access and termination fee.*
Cost of Goods:	20% of line revenue assumed

CONSTRUCTION OF THE NETWORK

A hybrid fiber-to-the-curb (FTTC) network of analog video and small digital loop carrier (DLC) was chosen for the model. This network architecture provides sufficient flexibility for the assumed service set. When video take rates are expected to exceed 20%, the high fixed and low variable costs of an analog video network are justified. If expected take rates are below this level, the incremental costs of putting digital video on the existing network can be justified. This network assumption is valid, given the current availability and pricing of video electronics, but is likely to change as technology adaptation and digital video is more widely deployed. Ultimately, a common platform that offers all services, including high-definition television (HDTV),will be most cost-effective.

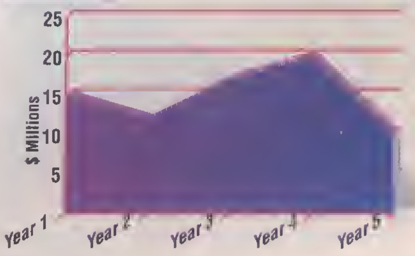
Telephony and high-speed data are best provided by a FTTC system in most urban and suburban areas, because this minimizes outside plant construction costs, reduces the size of distribution wiring, and facilitates delivery of multiple services on a common platform. Such a system also reduces operating costs by as much as 50% compared to conventional, copper-based technologies. Another benefit is the readiness of such a network to allow for other services, such as digital video. The model includes costs of electronics, fiber and copper, as well as engineering and installation expenses associated with installing the network in a densely populated environment. Figure 2 illustrates the annual capital expenses necessary to construct the entire network over a four-year period. The ability to build a network of this size should be prioritized by market requirements; four years is a reasonable timeframe.

The residential environment requires CLECs to begin operations with very low take rates, as they are establishing a customer base.Therefore, the ability to deploy a network that offers low initial costs, but provides sufficient flexibility to grow and provide high-quality differentiated services, is a tremendous advantage.

CHARACTERIZING THE SERVICES

Key assumptions were made in charac-

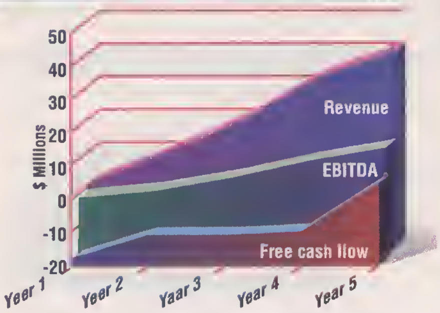
Figure 2: Annual capital expenses



terizing consumer choice of specific services and the willingness to pay for each service. The details of these revenue assumptions are shown in the sidebar (see page 13). Justification for each assumption is provided where a precedent service offering is available. The ability to offer a mix of services is a critical element. A service such as video, can be used in a service bundle to attract new customers.

- Video—Three tiers of video programming services are offered: basic (15 channels), standard (60 channels) and premium (60 channels plus premium channels). Pay-per-view is available to all consumers having a set-top box. Pricing and cost of goods for these services are based cable industry averages.
- Data—The data service includes Internet access via a high-speed xDSL or cable modem circuit. Caching of popular Internet sites is provided. Prices for cable modem services and 56 kbps modem sales verify consumer willingness to pay for performance. For the telecommuting and small office/home office (SOHO) markets, remote local area network (LAN) and business Internet services are based on a xDSL service offering.
- Voice—Telephony service assumptions are based on competitive plain old telephone service (POTS) and associated revenue. Revenue from special services is considered an upside potential and is not reflected in the numbers. Telephony revenue assumptions clearly reflect a conservative average when accessed, Class services and calling feature revenues are factored in. In this case, it's assumed that the CLEC will originate and terminate toll and long-distance charges, but not carry this traffic. As a result, the carrier captures only a portion of the associated revenue, intended to cover access and termination charges.

Figure 3: Analysis results



> **'Field of Dreams' plays heavily on the 'dream' aspect of multiple services.**

CASH POSITIVE

By combining services, the model dramatically increases the total revenue potential available to the CLEC. The business is EBITDA-positive before the end of the second year.

It was assumed that the capital expenses of network buildout would be incurred within the first four years; incremental capital expenses are required in later years as consumers are added. By the end of the fifth year, these expenditures are completed and the customer base is strong enough to create profitable returns on a network which is self-sufficient from a cash-flow point of view.

Figure 3 shows the results of the first five years of the business plan, covering network buildout and customer turnup. Only minor financial impacts should be expected after this five-year period as steady-state operations continue. There is also a tremendous upside to the model which is not captured—from special services offerings and potentially higher take rates of video customers to leveraging the telephony switch or video headend into other adjoining communities. Total revenue likely will not peak until four or five years into the project, because the CLEC is offering service in an area where no customer base exists.

A validation of this business case exists by extrapolating the success of the commercially focused CLECs into the broader service environment. As much as 75% of residential traffic in the U.S. is generated in areas with demographics similar to those modeled.

Thus, the opportunity exists to reach large populations with targeted network buildouts and, in doing so, provide a viable and sustainable business. Analyzing the exit or terminal value of the company as a multiple of EBITDA earnings at the end of 10 years shows a solid relationship between initial investment and total return. For this 10-year business case, the CLEC would achieve a 20% IRR on a capital investment of $75 million.

THE DECISION TO INVEST

Clearly, there is no single solution that will work in every residential market. Consumer interest varies, as do demographics and deployment cost. What is clear, however, is that there is room for competition in the residential market. It is also clear that a second player can build a successful business. However, unlike commercial markets and due to the high cost of entry, there doesn't seem to be an opportunity for three—and definitely not four or five—competitors in a single market. Being the first CLEC in the market matters.

Anyone entering this market should expect a fight on their hands. The ILEC has the clear advantage of having its network in place. Challengers will need to move quickly and find ways to offer a better value for customers by bundling services the ILEC fails to provide.

Various technology alternatives can be implemented, depending on market opportunity. For example, in low take-rate areas, a wireless network may be the most cost-effective solution. In areas where take rates reach 10% or higher, wireline service will need to be used.

Many have used a reference to the "Field of Dreams" when describing the deployment of full-service networks; they play heavily on the "dream" aspect of multiple services. It seems appropriate that we write a new standard for competition: "The field is already there; who wants to play?" ■

Earl W. Philmon is director of product management and Robert P. Kissel is business development manager at Broadband Technologies Inc. (Research Triangle Park, N.C.). Chris Janson is involved in broadband systems development at Lucent Technologies (Murray Hill, N.J.)

Photo: Bureau of Reclamation, Andy Pernick

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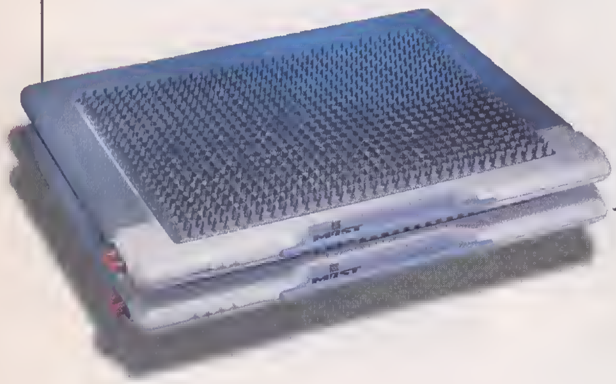

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SHIRA LEVINE

The little box that wasn't

The residential gateway concept is still alive and kicking, but many remain reluctant to commit.

The residential gateway has long been the sugarplum dancing in the telecommunications industry's head—a single box on the side of the house that acts as an interface between the service provider's network and the household's internal equipment, controlling services from POTS to high-speed data to video-on-demand to energy management.

But at this point, it's just that—a dream. With a few exceptions, there's little indication that it will be a reality anytime soon.

"There's a lot of caution out there," says Humberto LaRoche, distinguished member of technical staff with Lucent Technologies' Access Solutions division. "Service providers are beginning to evaluate the significance of residential gateways on their business case, but the cost issues associated with residential gateways are unclear at this early stage."

PIONEERS AT THE GATE

Still, carrier and vendor trailblazers are marching forward with residential gateway plans. Cox Communications (Atlanta) is trialing the Ericsson asynchronous transfer mode (ATM)-based residential gateway product in Oklahoma City. The CATV operator is delivering voice, high-speed data and energy management services to 50 "friendly" households, and is preparing to add video-on-demand to the service mix.

"Cox plans to be a full-service provider of voice, video and data services, rolled out over several markets," says Mark Davis, engineering director of telephony technology. "We want to find out from this trial whether this technology gives us a cost-effective advantage in providing all three services."

In comparison, Cox is delivering all three services separately using standalone boxes in Southern California. Cox will use the results from both systems to determine the level of integration that makes the most sense, Davis says.

The MainGate system from Scientific-Atlanta (Atlanta) offers similar capability to deliver multiple services on a single platform, but is targeted at electric utilities. MainGate works over a variety of wireless and wireline two-way networks to support applications such as automatic meter reading, service connect and disconnect, tamper detection, outage detection, and customer-controlled load management, and can support data services, security monitoring, telephony and video services. Florida Power Corp. (Miami), Gulf Power (Penascola, Fla.) and Braintree Electric Light Department (Braintree, Mass.) will use the MainGate system to offer advanced energy services within their regions.

POWERING ON AHEAD

The utilities are far ahead of the rest of the industry. For other vendors and service providers, residential gateway platforms are something they're looking at, but not yet buying. Reltec Corp. (Irving, Texas), for example, is opting to stay out of the residential gateway game for now, but is keeping a close eye on the action, says Toby Hoops, marketing communications manager.

Broadband Technologies (Research Triangle Park, N.C.), which already has a fiber-to-the-curb platform that delivers services from the optical network unit at the curb directly to the customer premises equipment (CPE) inside the home, plans to enter the gateway business, but by supporting another vendor's gateway product, says Earl Philmon, director of product management.

Finally, GTE (Dallas), while active in promoting the concept of the residential gateway, has "no announced plans for a trial," says Phil Feigel, director of technical strategic initiatives.

Cost is a major factor. Electric utilities have a demonstrated business case for implementing gateways: Remote meter reading can virtually eliminate the huge cost of sending trucks out to the home each month. With the gateways in place, the utilities have the infrastructure necessary to begin offering two-way telecommunications services as an added bonus.

"The residential gateway is attractive to utilities because it solves a specific goal, which is reducing the cost of reading meters," LaRoche says. "It has an immediate impact, and it can open the door to supporting additional broadband services at a later stage as those markets mature."

Yet, other service providers are more hesitant, particularly local exchange carriers (LECs) and CATV operators, which over the last year have pulled back on their grandiose plans to storm other markets. Without a clear business case for offering new services, many are reluctant to invest in new, pricey infrastructure.

"The business case works for telcos to provide telephone and maybe data services, and cable operators to provide video services, but when you combine all those functions into a gateway device, the business case has to be well-defined to make that investment," says Paul Pishal, product line director of data networking products at Scientific-Atlanta.

THE COST-BENEFIT CRUNCH

The cost of deploying residential gateways is considerable. "Putting a gateway on the side of the house is like putting in a little [ATM] switch," says Dave Spear, vice president of product marketing for Lucent's access solutions business.

Without a clear business case for gateways, many service providers are opting to sink their money elsewhere, says Michael Hawley, assistant professor of media at the Massachusetts Institute of Technology (Cambridge, Mass.).

> **Without a clear business case for offering new services, many are reluctant to invest in new, pricey infrastructure.**

"If you are a big company investing in infrastructure, there are a number of places you can put your money," Hawley says. "You can build faster switching systems or lay down new fiber or roll out advanced services such as [asymmetrical digital subscriber line; ADSL]. When all that starts happening, the thought is, why is the residential gateway needed?"

Service providers and vendors are focusing their efforts on the CPE within the house, Hawley adds. "Whatever the box is inside the home, whether it's a personal computer or an Internet TV device or an Internet telephone or even a smart refrigerator, there has to be something to connect to the network—otherwise, the entire issue is moot. That's where the energy is right now."

On the other side of the coin, there are features of the residential gateway that could save money for service providers. A gateway can centralize functions such as processing and powering, which can simplify or even eliminate devices such as modems and set-top boxes.

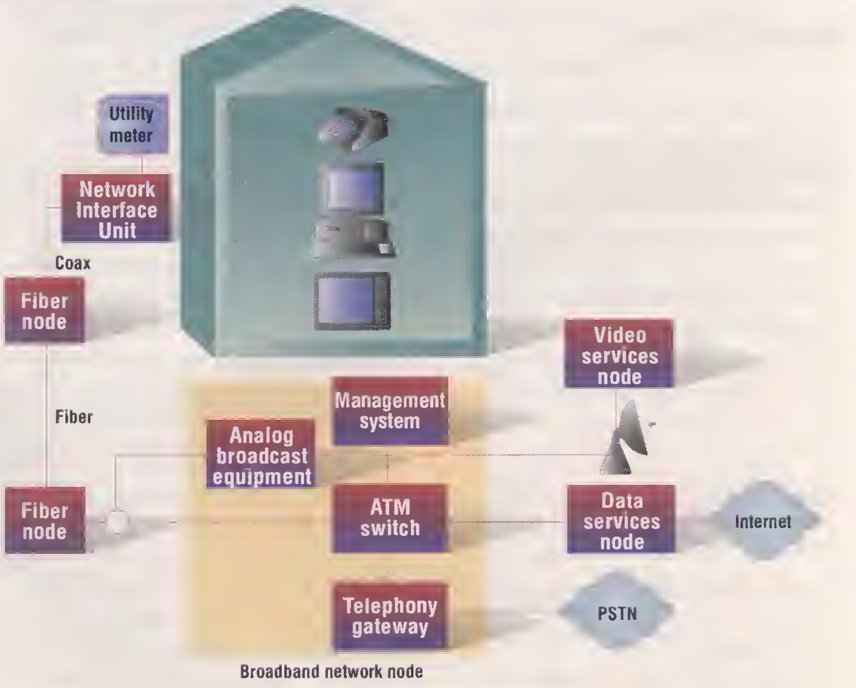
Because residential gateways are intended to be network-independent, they can allow a service provider—or even multiple service providers—to reach the customer through more than one type of transport, all seamlessly.

"The idea is that you could have any network on the distribution side, whether it's wireless, copper, fiber or coaxial cable, and even more than one kind of network, and the service set on the premises side of the gateway is one and the same," LaRoche says.

For now, however, the industry is waiting and seeing. Hawley says he sees people pushing in the direction of gateways, but calls it "just a blip" compared to the explosion of interest in services such as Internet TVs and enhanced POTS.

Gateway advocates remain optimistic. "The good news is that work is ongoing on several fronts," Feigel says. "The bad news is that no one has reached the Holy Grail yet." ■

The Ericsson-Cox residential gateway system in Oklahoma City



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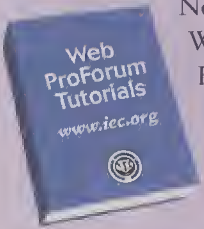

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- D ○ **Cable/Video/Multimedia Equip./Services** (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
- E ○ **Customer Premises, Broadband Subscriber Equip./Services** (PBXs, Station Equip., ACDs, Videoconferencing, Remote Controls, Converters)
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Remote Access Modules: Pricing and functionality

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Source: Cabletron Systems

ALCATEL UNVEILS BROADBAND SYSTEM FOR NEW ACCESS NETWORK OPERATORS

Alcatel (Richardson, Texas) says its new 9900 WW Radio enables operators of new access networks—such as competitive local exchange carriers (CLECs)—to provide a wide range of voice and data communications services quickly and economically to business clients in urban or suburban areas.

The high-capacity broadband access system uses point-to-multipoint radio technology, with high-speed time division multiplexing and packet switching to offer unequaled capacity and functions—including ATM and LAN-to-LAN connectivity.

The 9900 WW can, for example, serve carriers providing multiservice networks to small- and medium-sized enterprises (SMEs) in densely-populated areas.

The wideband multiservice capability of the 9900 WW is particularly attractive to new network operators focusing on SMEs. Industry analysts expect data communications services to grow to 60% of SME traffic, from 20% today, by the turn of the century. As a result, LAN-to-LAN connectivity will become increasingly important.

Alcatel announced earlier this year that it was working with **Stanford Telecom** (Sunnyvale, Calif.) to develop this product. Field trials will take place the first quarter of 1998, with a commercial launch planned for the second quarter. The 9900 WW will have a coverage area measuring several kilometers in diameter, depending on the frequency band used. A single central station, linked to existing wire line voice and data networks, can serve several hundred terminal stations.

The services provided range from circuit-switched voice communications (plain old telephone service and ISDN) to packet-switched data communications at rates ranging from 64 kbps to DS1 (1.544 Mbps) and European-standard 2Mbps increments. Dynamic, real-time allocation of available spectrum enables operators to make optimal use of frequency resources by offering high data transmission rates to many subscribers.

The Alcatel 9900 WW will operate in the 10 GHz to 41 GHz frequency bands and will conform with specifications defined by the DAVIC (Digital Audio-Visual Council) Forum, Federal Communications Commission and the European Telecommunications Standards Institute (ETSI).

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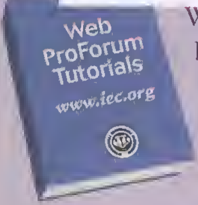

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Vertel	TMN
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BROADBAND Notebook

CHARLES MASON

CABLETRON PRODUCING REMOTE ACCESS MODULES FOR MMAC-PLUS

Cabletron Systems (Rochester, N.H.) is producing Remote Access Modules for its MMAC-Plus multimedia switching platform. The move is another in a series of offerings allowing Cabletron's SmartSwitch architecture to extend to the wide area network (WAN), according to company executives. The same advanced management, scalability, and security features that support Cabletron's Ethernet, Fast Ethernet, Gigabit Ethernet, asynchronous transfer mode (ATM), fiber distributed data interface (FDDI), and Token Ring technologies are now applicable to integrated services digital network (ISDN), analog modem, frame relay, leased line, and X.25 from the same chassis, the company says.

Chris Oliver, director of manufacturing and engineering at Cabletron, says the company's merging of WAN and local area network (LAN) switching contrasts with other industry solutions which focus on router technology.

Unlike the router architecture, the Cabletron Remote Access Modules will provide remote and branch sites with a non-blocking architecture; the capability to scale as networks grow; comprehensive management of remote access implementation and traffic-flow; and the unrivaled ability to apply switched-based, auto-learning configuration to remote access, according to Oliver.

Implementing remote access from a centralized router with added LAN interfaces requires manual configuration of devices, offers only a fraction of the total bandwidth capacity at any given time, does not scale well for growing networks, cannot keep running when a functional failure occurs, and does not offer comprehensive manageability, Oliver says.

"Cabletron's integrated LAN and WAN technology not only eliminates customer need for added rack, floor and cabling space, but also additional management, automation and security features," Oliver says. "Cabletron's LAN/WAN solution frees customers from much of the usual physical space, time and personnel resource requirements needed to set up and manage remote access capabilities."

Oliver says the Remote Access Modules provide Layer Two and multiprotocol Layer Three switching as well as bandwidth-on-demand and network-layer spoofing to move information optimally between central sites and dial-in users. WAN protocol support includes PPP, Asynch-PPP and MultiLink-PPP. Robust security is provided via several mechanisms. The modules are hot swappable and auto-configurable to support mission-critical on-demand networking; are fully interoperable with leading remote site ISDN equipment, such as the Cabletron CyberSwitch family, as well as with leading analog modems; and can be managed with Cabletron's Spectrum Enterprise Manager. The 9W006 and 9W007 Remote Access Modules will be available in January.

Remote Access Modules: Pricing and functionality

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9W007-2202	ISDN PRI/E1s + 60	$45,745	56K digital modems

Source: Cabletron Systems

ALCATEL UNVEILS BROADBAND SYSTEM FOR NEW ACCESS NETWORK OPERATORS

Alcatel (Richardson, Texas) says its new 9900 WW Radio enables operators of new access networks—such as competitive local exchange carriers (CLECs)—to provide a wide range of voice and data communications services quickly and economically to business clients in urban or suburban areas.

The high-capacity broadband access system uses point-to-multipoint radio technology, with high-speed time division multiplexing and packet switching to offer unequaled capacity and functions—including ATM and LAN-to-LAN connectivity.

The 9900 WW can, for example, serve carriers providing multiservice networks to small- and medium-sized enterprises (SMEs) in densely-populated areas.

The wideband multiservice capability of the 9900 WW is particularly attractive to new network operators focusing on SMEs. Industry analysts expect data communications services to grow to 60% of SME traffic, from 20% today, by the turn of the century. As a result, LAN-to-LAN connectivity will become increasingly important.

Alcatel announced earlier this year that it was working with **Stanford Telecom** (Sunnyvale, Calif.) to develop this product. Field trials will take place the first quarter of 1998, with a commercial launch planned for the second quarter. The 9900 WW will have a coverage area measuring several kilometers in diameter, depending on the frequency band used. A single central station, linked to existing wire line voice and data networks, can serve several hundred terminal stations.

The services provided range from circuit-switched voice communications (plain old telephone service and ISDN) to packet-switched data communications at rates ranging from 64 kbps to DS1 (1.544 Mbps) and European-standard 2Mbps increments. Dynamic, real-time allocation of available spectrum enables operators to make optimal use of frequency resources by offering high data transmission rates to many subscribers.

The Alcatel 9900 WW will operate in the 10 GHz to 41 GHz frequency bands and will conform with specifications defined by the DAVIC (Digital Audio-Visual Council) Forum, Federal Communications Commission and the European Telecommunications Standards Institute (ETSI).

CHARLES MASON

The TRUTH about CDMA

Critics of Code Division Multiple Access are missing the point, say carriers, vendors and analysts. Fact is, if you have capacity issues, CDMA works.

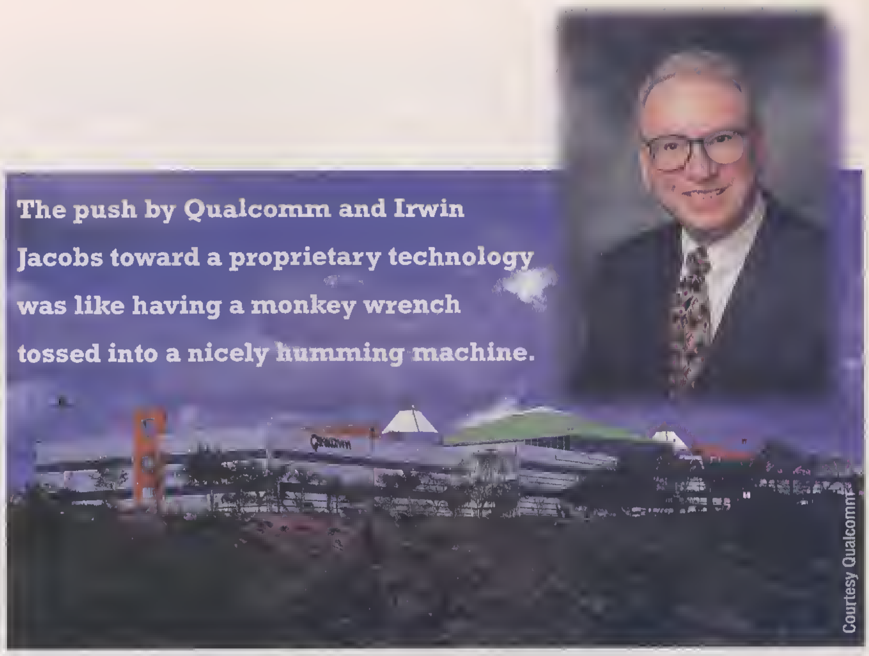
WHEN IRWIN JACOBS, A BESPECTACLED, AFFABLE MAN WITH A DISTINGUISHED CAREER AS AN ENGINEER, STOOD UP BEFORE A CONFERENCE ROOM IN AN ARLINGTON, VA., HOTEL IN THE LATE 1980S, FEW KNEW THAT THE COMPANY HE HEADED WOULD BECOME SUCH A SIGNIFICANT AND CONTROVERSIAL PLAYER IN THE TELECOMMUNICATIONS INDUSTRY. IN THE ENSUING YEARS, QUALCOMM INC. (SAN DIEGO), AND ITS CODE DIVISION MULTIPLE ACCESS (CDMA) TECHNOLOGY HAVE TAKEN THE UNITED STATES BY STORM. MANY OTHER NATIONS ARE TARGETED FOR CDMA ROLLOUTS.

Now, after spending tens of millions of dollars to deploy CDMA, some are asking how much more carriers will have to spend to fine-tune and increase the robustness of their networks as they add subscribers. To the continuing dismay of those who thought The Great Air Interface Wars were quieting down, CDMA critics are, once again, taking pot shots and resurrecting issues that proponents thought had been settled.

CDMA'S BIG PUSH

During the meeting in that Arlington hotel, Jacobs methodically played tape recordings of people taking over Time Division Multiple Access (TDMA) and CDMA. It was clear to most in the room that CDMA, at least under controlled conditions, had superior voice quality.

However, voice quality alone would not be enough to derail the industry as it rumbled toward adopting TDMA as the wireless strategy for the future. When Jacobs was talking CDMA to anyone who would listen, the U.S. wireless industry already was well on the way to selecting


The push by Qualcomm and Irwin Jacobs toward a proprietary technology was like having a monkey wrench tossed into a nicely humming machine.

Courtesy Qualcomm

TDMA. To some, the train had left the station; but Jacobs was not to be dissuaded.

Resentment soon was in the air. The push by Qualcomm and Jacobs toward a proprietary spread-spectrum technology was, for some, similar to throwing a monkey-wrench into a nicely humming machine.

From the beginning, the technology was controversial. Qualcomm said its CDMA proprietary technology was built on software and the power of the microchip—not on amplifiers. Rather than relying on turning up the power to attain required coverage, CDMA was described in the early years as a more "elegant" solution. Each conversation would be encoded; this unique code, as Qualcomm described it, would distinguish one conversation from another. Microprocessors would regulate the output power not only on the infrastructure side of the transmission, but on the terminal side as well, providing unparalleled flexibility.

It was an interesting idea. But CDMA's intricacies confounded some people, and led them to question how well it would work in the real world. The naysayers said flatly that it would not work.

As a result, early opposition remains palpable for some, even today. Critics continue to knock CDMA; even though the technology is running and works, even on heavily loaded systems as in South Korea, the critics now say that CDMA is not living up to the economic model that carriers expected.

IS-95 IS BORN

It was after a few field trials, a marketing push that would make Microsoft proud and the winning of influential backers that CDMA became a wireless industry standard in 1993 when the Telecommunications Industry Association (TIA) adopted IS-95.

Qualcomm was able to license the technology to most major wireless infrastructure vendors, including Motorola Inc., Lucent Technologies and Northern Telecom Inc. (Nortel). Ericsson and Nokia were holdouts on the infrastructure front, and while Nokia now offers CDMA handsets, Ericsson executives remain adamant that IS-95 is a technology they will not support.

Despite not being totally field-proven, CDMA proponents believed there were several compelling reasons to adopt IS-95 for mobile applications:

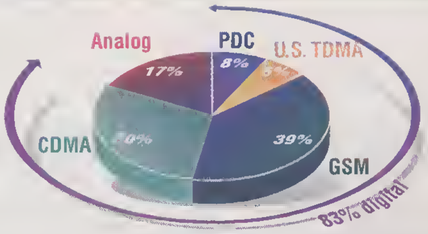
- It was compatible with the Advanced Mobile Phone Service (AMPS) networks;
- It promised to require fewer cell sites—a strong attribute for the personal communications services (PCS) networks carriers were planning to build; and
- The cellular carriers' race to digital had become more of a stroll, made possible by easing concern over capacity problems with analog, thanks to technological innovations that prolonged the life of AMPS-based networks.

Many were beginning to believe that they had time to wait for CDMA to prove itself.

COST AND CAPACITY

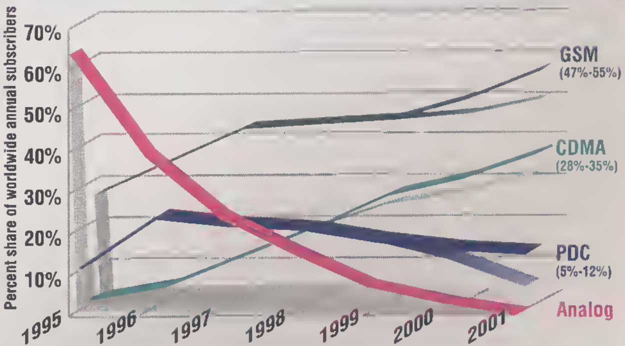
IS-95 was expensive to deploy. It was more technically com-

Contract awards by technology (July 1995 to December 1996)



Source: Merrill Lynch

Digital technology outlook
(annual new subscribers added by technology)



Source: Motorola

> *'We are living proof that CDMA, when engineered properly, is more than capable of fulfilling its promise.'*

Centennial Communications gives its business case for deploying CDMA in Puerto Rico.

Rudy Graf

My advice to wireless carriers faced with the monumental task of selecting an air interface technology for their new digital networks is simple: Forget the rumors. Forget the innuendo. Let the facts speak for themselves.

As Centennial Communications prepared to enter Puerto Rico as its newest personal communications services (PCS) provider, we at Centennial had no preconceived notion as to which technology we'd hang our hats on. While we had heard the claims of cost savings and performance gains of the various technologies, we did not take these claims at face value. To succeed, we needed to build our business on facts.

Without question, the future of Centennial was tied to the technology we selected. It would shape our auction strategy by defining how much we could spend for the spectrum and still maintain a financially viable business case. There was no room for error.

Centennial was not content with relying on the rumored performance comparisons of the technologies. We found these comparisons to be overly subjective, and uncertain at best—not the bases for the type of "bet your business" decision we faced. We needed hard evidence.

We also needed a technology in which all system and network interfaces were defined by industry standards. It was the only way we would have the freedom to choose the billing system, customer care environment, subscriber units and services that met our needs. A multivendor network would help distinguish us from our competition and would gracefully evolve in tandem with the underlying technology we embraced. We were looking beyond merely replicating traditional mobile services.

After an exhaustive review, Centennial chose Code Division Multiple Access (CDMA), because it works. CDMA, as defined by the IS-95 standard, afforded us the ability to deploy a low-cost network that would provide mobile and fixed access. This meant we'd have the ability and the competitive advantage to do things with wireless in Puerto Rico that no one had ever done before.

Holding the vendor accountable. Centennial defined a stringent set of objectives and measurable test criteria; this would form the basis for our selection of technology and vendor. We required any vendor pursuing our business to provide a warranty on its products and accept financial penalties if it could not pass our specific acceptance tests.

Our acceptance test criteria included objective measures for timely delivery and performance of the network, as well as reliability and quality of the service being delivered. We based all related acceptance tests on objective link budget measurements. The link budget, which expresses the maximum amount of degradation (in decibels; dB) that a radio signal can withstand, would directly affect the number of cell sites and base stations we needed to provide quality coverage.

continued on page 28

plicated, requiring a lot of software development and debugging. Volume orders that could drive down costs were not yet there. In fact, volume orders of CDMA infrastructure equipment are still below front-runner GSM (Global System for Mobilization), adding to the cost differential.

While such orders are building, GSM likely will remain a cheaper technology to build out initially—with a per-base station basis for the near term. GSM handsets are plentiful and cheap—something that has yet to happen for IS-95 handsets, although CDMA costs are starting to come down.

"We have seen significant decreases in the prices of CDMA equipment," says Graham Haddock, vice president and general manager of Motorola Cellular Infrastructure Group's personal communications division. "This is a trend that will continue as volume continues to build."

Clint McClellan, wireless industry analyst with Dataquest Inc. (San Jose, Calif.), says vendors of PCS IS-95 cell sites are beginning to offer equipment for less than $300,000—as much as a $50,000 drop in previous prices.

Given the higher costs of equipment and the lack of available handsets, Qualcomm has had its work cut out for it in convincing some cash-crunched carriers—especially the PCS providers—to adopt CDMA. In a controversial study released during the prolonged licensing procedures for PCS, Qualcomm claimed wireless carriers could save

Factors behind the choice of digital standards

Factors	IS-95	IS-36	PCS 1900
PCS (singlemode)	$250,000 per cell	$150,000 per cell	$100,000 per cell
AMPS overlay (dual mode)	$175,000 to $250,000	$5,000 per voice channel	Not possible
Infrastructure availability	High	Low	Very high
Time to market	Medium (increasing as more vendors enter the market and as the technology matures)	Medium	Fast
Handset availability	Low	Medium	High
Handset cost	Medium to high (new entrants should drive down prices in early 1998)	Medium	Low
Spectral efficiency	High	Medium	Medium/low
Global production sales	Growing	Flat (AT&T is largest customer)	High
Financing	High	Low	Low
Voice quality	High	Medium	Medium/high
Cell coverage areas	Large	Medium	Medium

Source: DataQuest Inc.

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Building The Wireless Future

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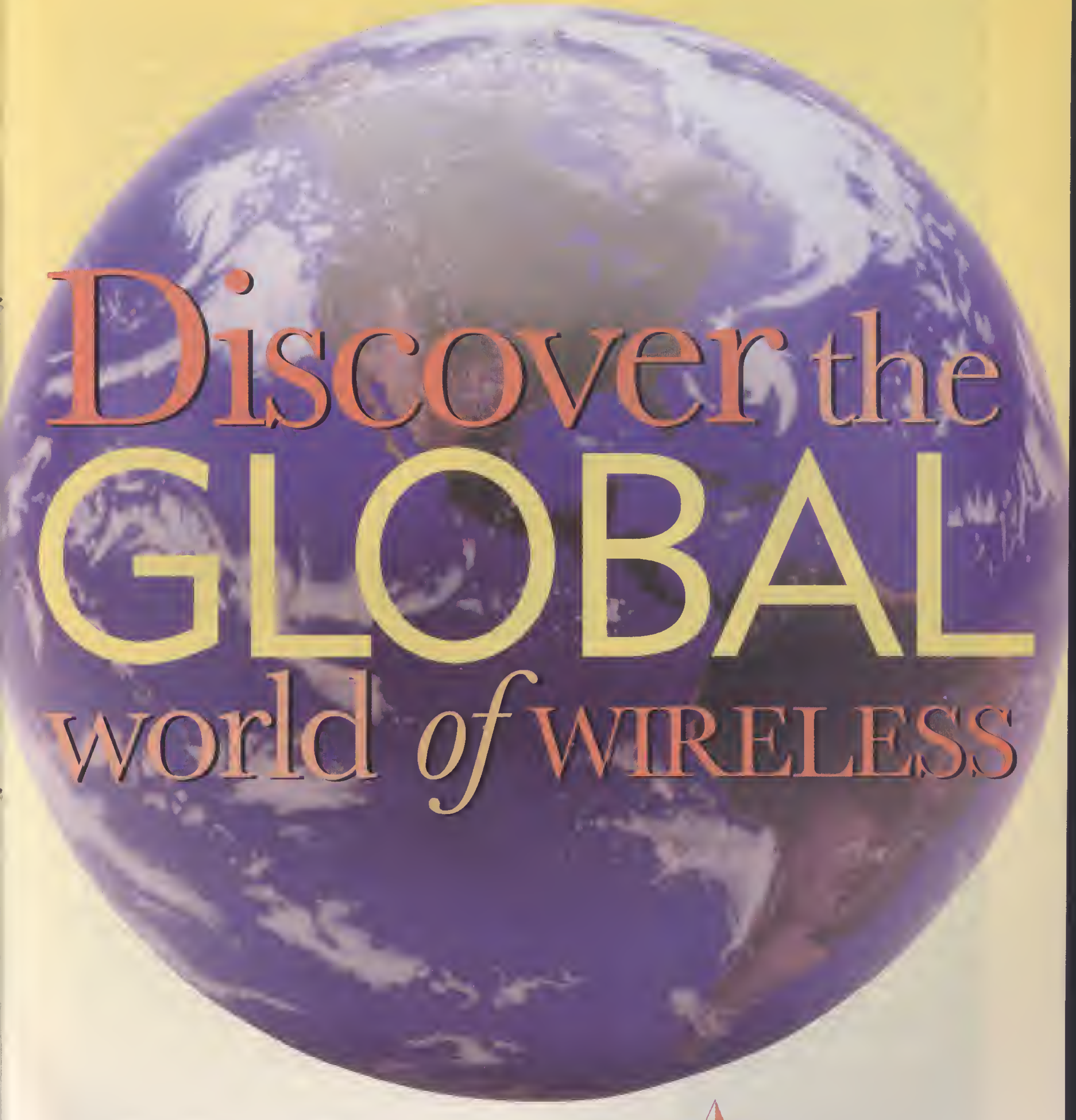

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Circle # 109

money by deploying CDMA. Qualcomm argued that, despite higher initial equipment costs, CDMA would wind up being more economical over the long run, because it required fewer base stations. In addition, Qualcomm claimed that CDMA had at least a 10-fold capacity of analog cellular; some earlier claims ran as high as 16 times that of AMPS. (Capacity advantages claimed here varied over the years and depend in part on the level of voice quality a carrier wants to offer. Higher voice quality diminishes capacity.)

A former Qualcomm executive, who asked not to be named, acknowledges the study was exaggerated. "It was based on theoretical estimates that had no basis in the real world," he says. "It wasn't a lie; it just wasn't realistic."

> **'We knew some of the claims being made were bull,' acknowledges one vendor. 'But...the technology works.'**

However, executives from carriers using CDMA say they're pleased with the capacity seen to date. Vendors, moreover, say they were never taken in by the hyperbole, regardless of the source.

"We knew some of the claims being made were bull," says an official for a vendor of CDMA equipment (who also didn't want to be named). "We had to build this equipment and we were aware of reality. But the truth is that, while there were exaggerations, the technology works and delivers basically what the customers need. And that's the bottom line. It's far from perfect, but what is perfect?"

Carriers that have built CDMA networks are unanimous in their praise for the performance of the technology. AirTouch (San Francisco), for example, operates CDMA in its cellular networks and as part of the PrimeCo PCS partnership. Craig Farrill, strategic technology officer for AirTouch, says his company is happy with CDMA's performance.

"CDMA has developed huge support,

because it delivers on promise," Farrill says. "The fact that the mythology of CDMA flaws continues is mind-boggling. The technology works—period."

Farrill points out that carriers today can build new CDMA wireless networks at half the expense of what it would have cost to build an equivalent analog cellular network. "It's simply not true that we have found that CDMA is going to be more costly than we thought," he asserts. "The long-run costs are actually less. The number of sites needed is less, and each site has more capacity.

"When you consider all of the costs involved in building a site, including zoning issues, that is a huge plus," Farrill continues. "Will we have to add sites and do other optimizing over the years? Sure. That's part of a growing business."

Qualcomm executives maintain they never made claims that weren't substantiated.

AirTouch, along with others, carefully considered the long-term costs of CDMA when making key decisions. "We're in this business for the long haul," Farrill says. "That's how you make money in the wireless business. And CDMA offers better performance at the best financial level of any technology."

Qualcomm executives maintain they never made claims that weren't substantiated. "We've said repeatedly that, in terms of base stations, for example, you can have far fewer base stations than you could with AMPS," says Charles Wheatley, senior vice president of technology. "But you can't have one-third of the base stations if you want 10 times the capacity. There is always a tradeoff between base stations and capacity."

Wheatley says the number of base stations, along with voice quality and coverage, all vary, depending on a carrier's business strategy. "What level of service quality, the projected airtime usage and subscriber levels must all be

Air Interface spectrum efficiency

	AMPS	U.S.TDMA	GSM	CDMA (mobile)			CDMA (WiLL®)
				(3-sector)		(6-sector)	(3-sector)
Carrier spacing (MHz)	0.03	0.03	0.20	1.25	1.25	1.25	1.25
Vocoder rate (kbps)	NA	8	13	8	13	8	8
TCH/carrier	1	3	8	18	11	16	31
Reuse pattern	7	7	4	1	1	1	1
Capacity TCH/MHz/cell	4.8	14.3	10.0	43.2	26.4	76.8	74.4
x AMPS	1x	3x	2x	10x	6x	16-18x	16-20x

Source: Motorola

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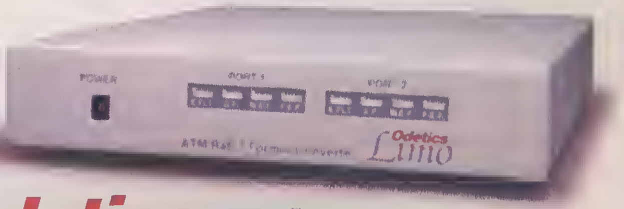

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Circle # 110

> **'The cellular business model is not working for PCS. The airtime usage is much higher because of promotional pricing.'**
>
> ***—Graham Haddock, Motorola***

taken into account, just as with anything," he says.

Critics who now claim that CDMA will need far greater number of cell sites than previously estimated are missing the point, Wheatley asserts. "CDMA offers many tools, and every carrier has its own approach to deploying a network, depending on the market, business model and many other variables," he says. "You should be designing ahead of time so that you design the system based on longer-term capacity estimates. But when your network usage goes beyond your estimates, you are going to have to add base stations. That's true with any air interface technology."

Some carriers have been surprised at how much additional airtime is being used by their new digital subscribers—a fact attributed to the lower prices being charged for digital service, according to observers.

"The cellular business model is not working for PCS," says Motorola's Haddock. "The airtime usage is much higher, because of the promotional pricing. That affects network planning and requires some fine-tuning as you go forward."

Butch Weaver, senior vice president of engineering at Qualcomm, says changes and enhancements to CDMA have been ongoing since the first system was turned on. "Vendors have tightened up their specs, and there will be continual improvements and fine-tuning, such as in the software," he says.

Miscalculations have been made regarding the number of base stations needed, according to Wheatley, because carriers have not always taken into consideration one issue: the soft handoff. "There are some people who are not

continued from page 24

Our radio frequency (RF) plan anticipated rapid subscriber growth in Puerto Rico. We incorporated the RF plan (and the assumptions that shaped it) into our acceptance test. With heavy traffic loads expected, our network was designed with higher erlang traffic per subscriber than typically engineered for traditional mobile cellular networks. Again, we relied on the link budget.

Unlike some of the other performance comparisons of AMPS vs. CDMA, the link budget was a measurable test that accurately represented the propagation characteristics of the air link in the network. Because link budgets can be measured in test-driving the entire network, we could verify that the performance claims of the vendor were being fulfilled.

We found the link budget of a CDMA network was 5 dB to 7 dB better than other technology choices; this would enable us to build a network with higher capacity and fewer base stations. Centennial also could establish a footprint in Puerto Rico that was extensible and scaleable, in anticipation of future success. For example, even though we engineered the initial network with a single 1.25 MHz RF carrier to cover the entire island, we expected that multiple carriers would need to be added eventually in the major cities and towns to handle mobile and fixed services.

After studying the extensive CDMA field trials in mobile and fixed applications that had been performed over the years, we were convinced that CDMA would have a more rapid gestation period and enjoy commercial success far more quickly than its digital predecessors. Knowing that it had been "stressed" in multiple laboratories by vendors that were committed to introducing CDMA technologies, we felt comfortable that we could manage the risk associated with deploying a new technology.

Another point in CDMA's favor was its cable microcell integrator/headend interface converter (CMI/HIC) capabilities. CMI/HIC, which is supported only by CDMA, enables CATV operators owning a wireless license to deploy remote antennae on their cable strands for routing signals back to the cell site. The cell site, in turn, provides the RF for that antenna driver. Thus, a wireless carrier can achieve wide coverage simply by deploying a relatively inexpensive series of remote antennae on an existing cable system. For Centennial, this was an intelligent and cost-effective method for improving our reach.

The viability of CDMA. Centennial's network is testimony to the viability of CDMA. We have found that CDMA lives up to our expectations. The demand for Centennial's services is an indication that the people of Puerto Rico find our service superior to the competition. We have added a second RF carrier (representing an additional 1.25 MHz of spectrum) to portions of our network where subscriber demand or use on a per-subscriber basis requires additional network capacity. We're also about to add a third RF carrier.

In addition, we've had great success with cell boundary hard handoffs, handups and hand-downs.

It's important to note that Centennial experienced no trouble in developing the algorithms required to realize the full potential of CDMA. We are living proof that CDMA, when engineered properly, is more than capable of fulfilling its promise.

With one network capable of delivering mobile and fixed wireless services, Centennial has embarked on the next deployment phase: offering fixed services as a substitute for traditional wireline service. Our fixed service offering, HomePhone, will use the 13 kbps vocoder, just like our mobile service. We believe its superior voice quality is a necessity to our success in competing against wireless and wireline incumbents.

The strength of CDMA is evident in the fact that Centennial was immediately in the fixed wireless business simply by marketing new subscriber units that more closely resembled traditional telephones. We were able to take advantage of the network's capacity in a way that allowed us to offer a fixed service that was separate and distinct from our mobile service, yet still used the same base stations and switches. No other air interface was able to provide this ability.

I believe that most detractors of CDMA have not taken the time to investigate its capabilities fully. The telecommunications business should be based on measurable fact, not rumors; we must include quantifiable tests in our fundamental agreements with the technology providers.

Centennial chose CDMA because it offered the highest quality service at the lowest cost, and it extended the paradigm of wireless service beyond what our competitors were contemplating. One only has to look at the third-generation CDMA activities taking place to see how this technology is fulfilling its promise.

I invite anyone who is interested to visit Centennial and see for themselves how a CDMA system works, and works well.

Rudy Graf is president of Centennial Communications, parent company of Centennial de Puerto Rico.

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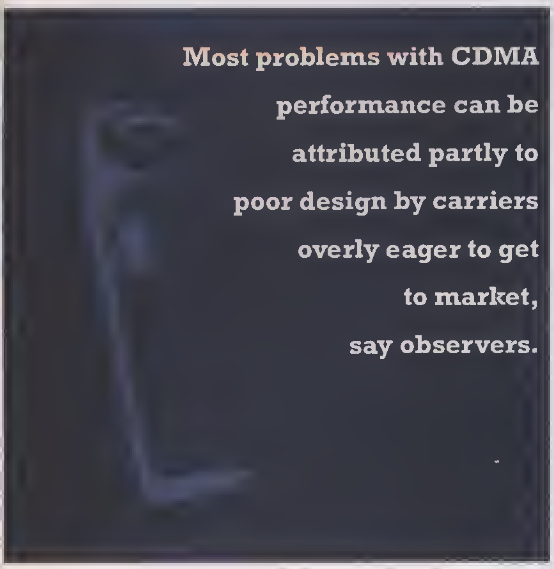


Most problems with CDMA performance can be attributed partly to poor design by carriers overly eager to get to market, say observers.

getting as much out of their networks as they could and will," he says. "There is a learning curve. Everybody didn't go through all of the steps they were supposed to go through."

Wheatley dismisses critics who say CDMA is extraordinarily difficult to optimize. "It's different from what they are used to, so they think it is hard," he notes. "CDMA is not intuitive, but it's not that hard to optimize. With any new technology, you are going to have a learning period. We never claimed you wouldn't have that learning curve with CDMA."

In fact, most of the current problems with CDMA performance (while relatively minor) can be attributable partly to poor design by carriers that are overly eager to get to market quickly, according to observers. Qualcomm officials won't agree publicly, but they take note of the fact that some PCS providers have been in a hurry to turn on their systems despite the current shortage of highly skilled radio frequency (RF) engineers.

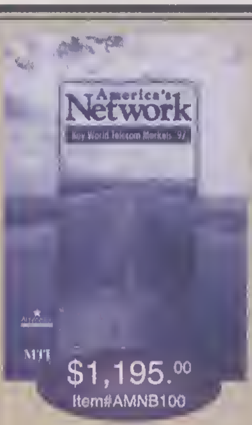
UPBEAT FORECAST

Any new technology will have bugs and optimization issues, and CDMA is no exception, says Herschel Shosteck, a Wheaton, Md.-based wireless market researcher and analyst. Deploying networks as quickly as possible can exacerbate problems, too.

"There is a five-year period of pain with any of these technologies," Shosteck says. "GSM went through it. They all do."

CDMA may well end up costing more to operate than carriers thought; however, that's not unique, Shosteck says. "They found out with GSM that they needed greater cell density than first projected," he notes. "The same appears to be partially the case with CDMA."

While Shosteck believes CDMA will be a robust technology and deliver on its most important promises, he says the whole debate about air interface technologies has been overblown—and counterproductive. "I think that different technologies work best in different situations," he says. "But the issue now



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should be about delivering the next generation of services."

Jeff Lipton, an analyst with Hambrecht & Quist (San Francisco), says any problems that have arisen do not affect his confidence in the overall robustness of CDMA. "You always have problems with any new technology," he says. "You have tremendous amount of talent working on CDMA. And while CDMA is more expensive, it makes sense if you have capacity issues."

Other long-time observers also dismiss the concerns over CDMA. Ira Brodsky, president of Datacomm Co. (Chesterfield, Mo.), says flatly that CDMA networks will not prove unduly costly to operate. "There is absolutely no evidence or any reason to expect hidden, apocalyptic costs to materialize," he says. "Quite the contrary; the suggestion is that CDMA will have a lower overall cost to operate in the future."

GSM, because of its infrastructure costs, makes sense in smaller PCS markets where a carrier does not expect to face heavy congestion, according to Dataquest. In a recent comparison of the costs of air interface technologies, the research firm found that a voice channel for the leading technologies, based on the radio portion of the network, runs from $9,000 for IS-95 (CDMA) operating at the voice-quality optimum of 13 kbps, to $7,000 for IS-136 (enhanced TDMA) and $6,000 for PCS-1900 (upbanded GSM). "Larger carriers that will face severe congestion problems will be better off with CDMA," Dataquest concludes.

Interestingly, everyone—including sharp critics of Qualcomm's CDMA technology, such as Ericsson—are already talking about the promising future of wideband CDMA. W-CDMA is likely to be supported during the next decade by all major vendors and carriers, analysts maintain.

GSM, because of its infrastructure costs, makes sense in smaller PCS markets where a carrier does not expect to face heavy congestion.

Ultimately, in spite of the negativism that continues to follow IS-95, CDMA, in one form or another, seems destined to be the player on the mobile and fixed wireless arenas in the new millennium. ■

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WIRELESS Notebook

CHARLES MASON

XYPOINT OFFERS LOWER COST E911 SOLUTION

Xypoint Corp.(Seattle) has developed what company executives claim is a low-cost wireless E911 solution based on a unique Integrated Services Digital Network User Part (ISUP)/SS7 signaling approach that doesn't require the installation of expensive hardware and software.

According to Larry Corvari, vice president of engineering at the company, the solution, called ISUP LENS, will make it easy and inexpensive for wireless carriers to deliver location-based services such as wireless E911. ISUP LENS is the first service in the Xypoint family of Location Enhanced Network Services (LENS).

ISUP LENS is a standards-based signaling protocol that does not require new software or hardware to meet the requirements of the Federal Communications Commission's (FCC) E911 mandate to wireless carriers. Beginning next year, the FCC has ordered wireless carriers to provide public safety answering points with the 10-digit callback number and originating cell location with every 911 call they handle. By 2001, carriers must provide more precise location information. ISUP LENS supports both phases of the FCC order.

Initial implementations of ISUP LENS will begin in January 1998. Corvari said that with ISUP LENS, carriers will be able to deliver the required information without installing costly new software or hardware.

Easily implemented switch translations are all that is required for wireless carriers that are ISUP-capable. Delivery of 911 data is achieved through existing SS7 connectivity such as the North American Cellular Network.

ISUP LENS is based on Telecommunications Industry Association's (TIA) industry standard PN 3581. Some vendors are offering solutionsthat require wireless carriers to implement expensive software and hardware, such as a home location register (HLR), into their networks.

Xypoint has been a proponent of SS7 with Transaction Capabilities Action Part (TCAP) messaging in the TR45.2 wireless E911 standards work. However, to date no standard has been adopted for TCAP messaging for location-enhanced services. TCAP requires switch manufacturers to develop and implement new software in the mobile switching center.

Corvari says Xypoint recognizes that TCAP messaging for wireless E911 will be available only when switch manufacturers can deliver it.

DTS WIRELESS UPGRADES SOFTWARE PRODUCT

Seeking to remove a barrier to adoption of wireless e-mail software, **DTS Wireless** (Woodbridge, N.J.) is offering its Zap-It Wireless Inbox as an addition to its line of Zap-It wireless messaging services.

According to Bob Lansey, president of the company, the Zap-It Wireless Inbox provides a one-mailbox solution allowing laptop and handheld PC users to wirelessly connect virtually anytime, anywhere to their existing e-mail mailboxes.

With the growing use of e-mail, market studies say that customers want accessibility wherever they are. However, they don't want to deal with multiple e-mail addresses or limited accessibility when they are not using their wireless device.

The new feature was developed in response to customer demand for a single e-mail address, accessible via landline or wireless connection, Lansey says. It enables seamless wireless access to existing LAN- or Internet-based e-mail accounts, requiring no additional wireless e-mail address.

Lansey said that with Zap-It Wireless Inbox, Zap-It subscribers not only can send and receive e-mail, but also send and receive messages to and from fax machines, pagers and phones, regardless of whether they are mobile or at their own desktops.

The company recently partnered with **CompuServe Inc.'s** (Bellevue, Wash.) **Sprynet** division to bring the Wireless Inbox capability to the Sprynet subscriber base.

According to the company, the Zap-It Wireless Inbox feature can be set up with varying levels of security, and can connect to most e-mail systems that are based on the PDP3 industry standard.

ITRON, UK DATA FORM UNIQUE VENTURE

Itron, Inc.(Spokane, Wash.) a provider of automatic meter reading (AMR) equipment and services to the utility industry, and **UK Data Collection Services Ltd.** (Central Mitton Keynes, UK) have formed a jointly-owned company to provide meter data collection services.

Itron and others involved in the nascent wireless AMR industry are trying to position themselves to take advantage of the significant changes within the electric utility industry as it moves to a deregulated and competitive environment.

It is widely recognized that information about energy use will be critical in a competitive power-supply environment.

In the past, utilities companies installed, maintained and collected data from meters for billing and other applications. This will change quickly as utility distribution companies (UDCs) and energy service providers (ESPs) look for the most cost-effective way of obtaining metering data, as well as solutions to the problem of metering those customers who are not in their service territory.

Company executives say the new joint venture will provide operational services in the areas of metering and energy data collection, processing, aggregation, load research, load profiling, billing and settlement in North America. These data acquisition services will be marketed to UDCs, ESPs, retail power marketers, and commercial and industrial customers with multiple metering sites, according to executives with the venture.

Itron and UKDCS each hold a 50% equity interest in the new company. Headquarters will be located in Raleigh, N. C.

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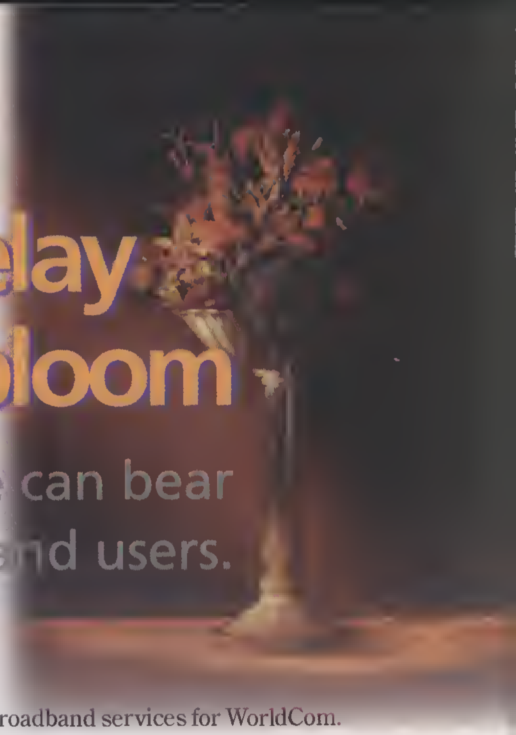


Frame relay enters full bloom

Ripening packet data service can bear fruit for carriers, vendors and users.

As 1997 draws to a close, frame relay is blossoming with new possibilities that result when a service has been deployed ubiquitously and customers have attained a high level of comfort by using it extensively.

First offered in 1992 by WilTel as an efficient means of connecting local area networks (LANs)—brimming with bursty packet data—across the public networks, frame relay began to gain critical mass in 1995, according to Rick Malone, principal at Vertical Systems Group (Dedham, Mass.). Customers have used the service primarily to replace expensive private lines used to carry non-mission-critical data. However, users' increasing experience with the technology has led them to begin to trust their frame relay networks with more sensitive traffic, such as Systems Network Architecture (SNA).

Customer comfort is only one of several clear signs that frame relay is reaching a new level of maturity. Others include:

- Continued healthy deployment;
- Introduction of switched virtual circuit (SVC) capability by a handful of carriers and vendors;
- Deployment of higher bandwidth links;
- A shift from unmanaged to managed service; and
- The emergence of new applications such as fax, videoconferencing and voice over frame relay (VoFR).

INSATIABLE DEMAND

Although interexchange carriers (IXCs) and local exchange carriers (LECs) are still deploying frame relay as fast as they can, deployment will begin to level off in 1998 and drop during the next two years. The slowdown won't be that hard to stomach; carriers hardly can keep up with current demand. Moreover, while deployment growth slows, carrier revenues from the service will continue to increase from $2.5 billion this year to $6.8 billion in 2000, according to Vertical Systems Group's "Asynchronous Transfer Mode and Frame Relay Update" report (Figure 1).

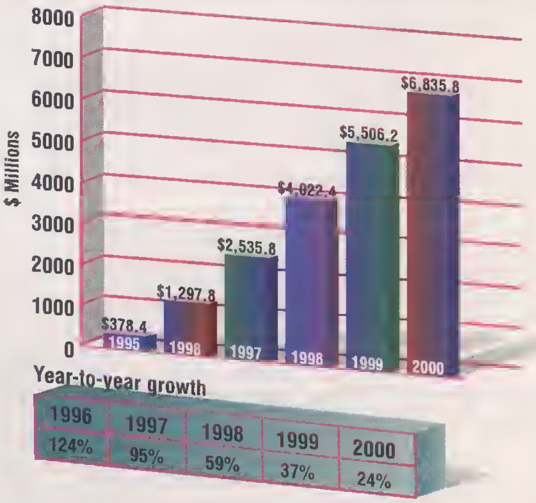
WorldCom Inc. (Jackson, Miss.) experienced a 140% growth in frame relay lines between 1996 and 1997, and the carrier is projecting a growth rate of 84% in 1998, says Kelly Pace, manager of broadband services for WorldCom.

Growth also will be healthy for companies such as Frontier Corp. (Rochester, N.Y.) that service small- to medium-sized businesses. Frontier, which on Oct. 1 expanded its service from a number of nodes in Rochester and Wisconsin to nationwide availability, now serves more than 100 customers. The carrier expects frame relay growth to "increase by magnitudes" next year, says Mike Fuqua, senior business development manager.

Sprint agrees. "The biggest opportunity for us is in the mid-market, between five and 30 sites," says Jim McWalters, group manager of frame relay for Sprint Business. "We have seen customers who are using frame relay to support LAN-to-LAN connectivity, the next wave of customers will be those that are converting from private lines to frame relay, and there is still a large percentage of private lines."

McWalters says frame relay will drive a large percentage of carrier revenues in 1998. He adds, however, that demand will start to level off due to the increasing popularity of Internet

Figure 1: U.S. Frame relay service market



Source: ATM & Frame Relay Industry Update (Vertical Systems Group) protocol (IP) networks and increased acceptance of asynchronous transfer mode (ATM).

Today, customers must define all frame relay networks endpoints and set up routing tables for one point to reach another.

FREE TO CONNECT

Another benchmark of frame relay's break from its youth came in October at the Networld+Interop '97 (N+I '97) show in Atlanta. Carriers and vendors announced their support of SVC frame relay and, under the banner of the Frame Relay Forum, discussed and demonstrated the ability to allow end users to set up connections with endpoints to which routing paths have not already been established. MCI (Washington, D.C.) announced it was trialing SVCs with several customers, and revealed plans to roll out commercial service nationwide on Dec. 1.

Four carriers and 12 vendors participated in the Frame Relay Forum's SVC Technology Tour. The carriers included LCI International (McLean, Va.), Sprint (Overland Park, Kan.) and the Unispan consortium. Vendors included 3Com (Santa Clara, Calif.), Ascend Communications Inc. (Alameda, Calif.), Bay Networks (Billerica, Mass.), Cabletron Systems (Rochester, N.H.), Cisco Systems (San Jose, Calif.), Digital Equipment Corp. (Littleton, Mass.), Harris & Jeffries (Dedham, Mass.), Hughes Network Systems (Germantown, Md.), Netrix (Herndon, Va.), Newbridge Networks (Kanata, Ontario), Nortel (Brampton, Ontario) and Trillium Digital Systems (Los Angeles).

Today, customers must define all of the endpoints in their frame relay networks and set up routing tables in their routers for one point to reach another. These preconfigured paths are known as permanent virtual circuits (PVCs). Most frame relay networks are deployed in star topologies, in which branch offices connect to a data center hub and interact primarily with the hub. When two branches need to communicate, data ususally passes through the hub, which can introduce delay.

Full-mesh topologies are more complex and expensive, and therefore less frequently built, especially as a frame relay network grows and the number of PVCs increases exponentially.

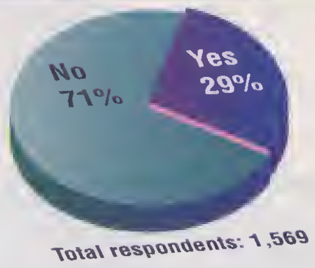
SVCs enable branch offices to link to one another on demand and without necessarily routing traffic through a central hub site. This eliminates variable delay and enhances frame relay's ability to support usage-sensitive applications such as voice, fax, disaster recovery, "push" technologies and videoconferencing. It also frees up valuable addressing space. "There is a limit to how many PVCs one router can support," says Melanie Hanssen, executive manager of HyperStream frame relay marketing for MCI.

Although SVCs enable let users communicate on-demand with any frame relay-capable end point, it's important to note that until intercarrier agreements and a standard addressing scheme are implemented by all carriers and vendors, endpoints establishing connections via SVCs must be served by the same network provider. In other words, an MCI frame relay customer could communicate via an SVC only with another MCI frame relay customer. Nevertheless, it's expected that end users will find SVCs useful.

"Customers want reduced costs, flexibility and simplified operation from their frame relay providers," says David Jacobs, founder and director of London-based intranet systems integrator Jacobs Rimell. "SVCs will cause a migration from star to mesh topologies as well as an increase in higher port speeds, the number of virtual circuits per port and the number of sites per customer."

Just when these things will occur remains to be seen. Only 29% of 1,569 end users surveyed by Vertical Systems Group professed a requirement for SVCs (Figure 2). The fact that SVCs can provide them with usage-based pricing and less-complicated, more-flexible provisioning is mitigated by the fact that carriers are pricing PVCs very aggressively and most carriers provide managed frame relay service for users who don't want to manage increasingly complex, PVC-based frame relay nets. SBC Communications Inc. (San Antonio, Texas) saw a marked increase in demand for managed frame relay over the past year, according to Irene Fuller, marketing director of frame relay.

Figure 2: End user SVC needs



Source: WAN Plans '97 (Vertical Systems Group)

"There is a requirement for SVCs. It is more than a niche, but it is not broad-based," Malone says, adding that he does not think frame relay SVCs will "take off."

The typical candidate for SVCs is a larger enterprise with peer-oriented requirements, rather than the typical data networking frame relay customer of today, he adds.

Not all carriers intend to support SVC frame relay—most notably, AT&T. The carrier has implemented asynchronous transfer mode (ATM) SVCs and is steering its customers toward frame relay to ATM interworking or just ATM for higher bandwidth applications, says Jim Daugherty, general manager of data services marketing for AT&T.

"There is not an overabundance of need for SVCs," Daugherty continues. "Even customers who say they want it account for only 5% to 10% of total frame relay traffic. Our focus when we look at frame relay is that it provides customers with a smooth evolution path to ATM. It allows them to support application sets that come out from developers, while we provide them with ATM class of service features that frame relay can't provide."

MCI and other carriers supporting SVCs disagree with the notion that customers are eager to migrate to ATM.

"Customers don't want to switch technologies to get this or that feature," says MCI's Hanssen. "They don't want to change technologies because it takes them years to get their networks up and running. After that, they like to add stuff to the existing network. There is a large base of installed PVCs that have worked pretty well to date. SVCs will give users other options to help them leverage their investment."

Even carriers planning to implement the service acknowledge that they've not yet seen a great deal of demand. They also realize that SVC implementation is not a piece of cake. According to Jacobs, the issues implementors face include:

- Security of inbound connections;
- Data link connection identifier (DLCI) limitations on frame relay switches and customer premises equipment (CPE);
- Call set-up performance;
- Reach, which is determined by interservice provider network-to-network interfaces;
- Lack of priority signaling;
- Tariffing;
- Modifying their frame relay billing engines to bill for usage-based service; and
- Competition from ATM SVCs.

Most carriers also agree that the majority of their customers are unfamiliar with SVCs and will need to learn more about the capability before service providers can market SVCs to them successfully.

"There's a fair amount of market education that will have to go on," says Brett Azuma, director and principal analyst of telecommunications for Dataquest (San Jose, Calif.).

Carriers such as MCI, Ameritech and Bell Atlantic that offered switched multimegabit data service (SMDS) probably have identified good candidates for SVC frame relay.

Although SVCs may simplify the provisioning process, they will complicate network operations because carriers won't know where the traffic is going to go from one moment to the next, Azuma adds.

"Traffic will be unpredictable and carriers will have to engineer their data networks like voice networks," he says. "And because data is new, they don't have much historical precedent to drive their new models."

Carriers planning to support SVCs in 1998 despite these hurdles include Bell Atlantic (if sufficient market demand develops), Frontier, US West (Denver) and LCI. Offering frame relay connectivity to 85 locations outside the U.S., LCI is installing SVC capability throughout its network. LCI is supporting SVCs so it can meet customer requirements for advanced types of services and speeds, says Leo McCloskey, senior product manager.

SBC will consider SVC deployment in 1998, rather than in 1999, due to the capability's earlier-than-expected rollout by other carriers, Fuller says. However, customer demand for SVCs is not making much of a blip on SBC's radar. "We are getting more inquiries about voice over frame relay," Fuller adds.

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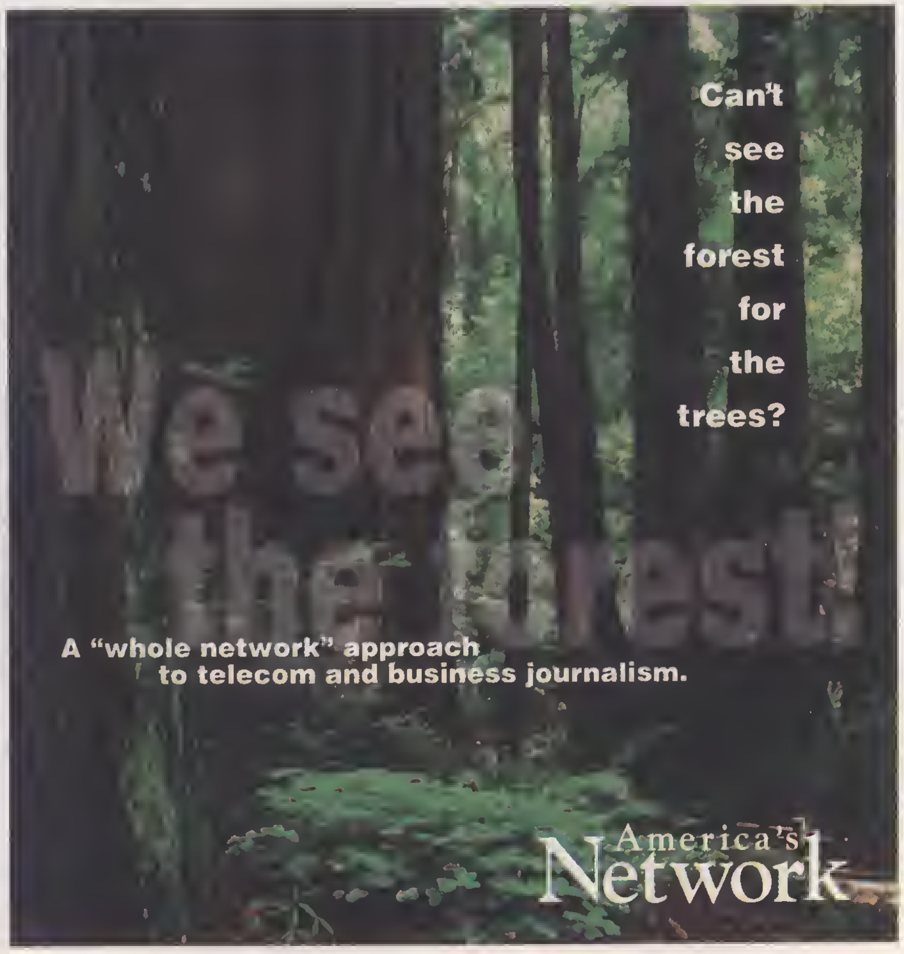
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Sprint may deploy SVC capability in the latter half of 1998, McWalters says, but for now the carrier plans to keep "close tabs" on demand to determine when and if deployment is warranted. In addition to offering customers more options, SVCs could provide carriers with some cost-saving opportunities, he adds. "SVCs would allow us not to have to have bandwidth permanently nailed up and reserved; instead, we could using that bandwidth only when we need it," he says. SVCs may not save customers much money, however, because the price of PVCs continues to decrease, he notes.

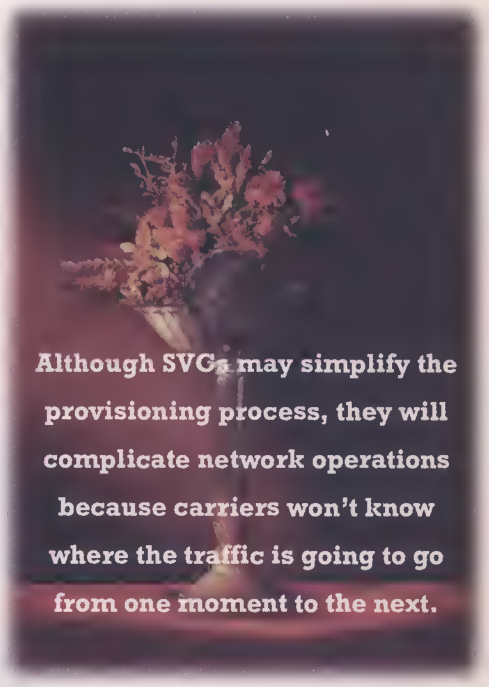
MCI had not announced its pricing for SVCs at press time.

US West is modifying its billing systems so it can rollout SVCs in mid-1998, says Todd Hirsch, director of data transport solutions for the carrier's !nterprise Networking division. "I just completed a presentation on frame relay SVCs at a customer advisory forum," he says. "It sounded like the biggest application from this customer set is data backup, disaster recovery and data dumping. Another reaction we got was that SVCs will make frame relay at higher speeds more efficient."

GO FASTER!

Another indication that things are changing on the frame relay front is increased demand for higher speed links. At N+I '97, GTE (Irving, Texas) announced it will offer 45 Mbps (T3) and committed information rate (CIR) frame relay throughout its region by the end of first quarter 1998. Ameritech (Chicago) announced region-wide availability of T3 frame relay and frame relay-to-ATM service interworking in its territory.

Ameritech expects T3 frame relay to account for 10% of its traffic during the next year, says Tim Whiting, senior product manager. "Customers with multiple T1s are looking at T3 frame relay as an interim or final step, because they don't want to, or don't need to, make the move to ATM, because they are running data only," he adds. "They understand frame relay and they just want it in a more effective manner at higher speeds."



Although SVCs may simplify the provisioning process, they will complicate network operations because carriers won't know where the traffic is going to go from one moment to the next.

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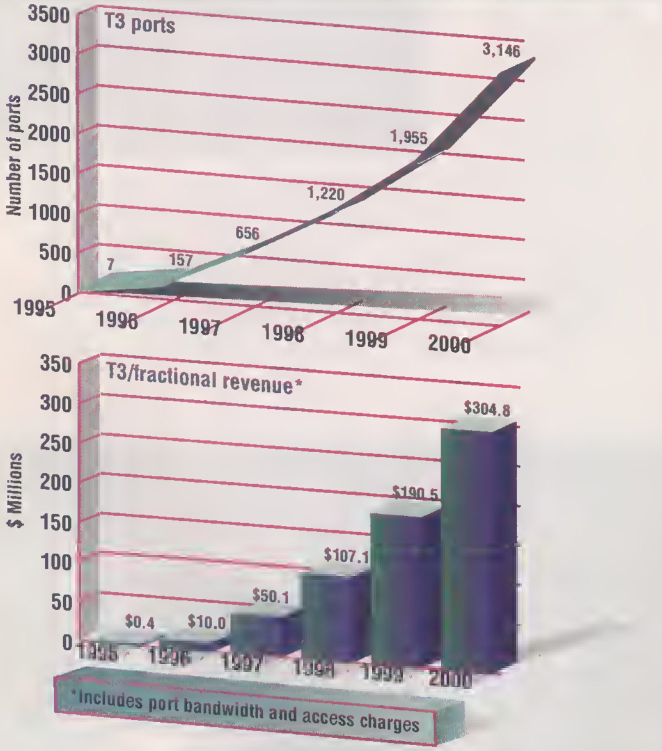
Nearly 20% of WorldCom's frame relay customers use fractional T3 or T3-sized pipes, Pace says. In US West territory and SBC's California region, uptake of T3 frame relay links has reached 5%. SBC is offering frame relay at T3 rates because it does not want to "push" customers to ATM if they are comfortable with frame relay, SBC's Fuller explains.

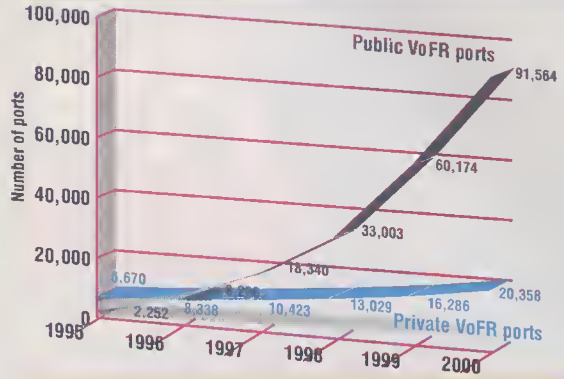
Hirsch notes that US West customers running multiple 1.544 Mbps (T1) links can save money by moving them on to a T3 link, after which the service can be managed out of one port.

Figure 3: U.S. Frame relay service market
T3 frame relay connections



Source: ATM and Frame Relay Industry Update (Vertical Systems Group)

Figure 4: Voice over frame relay ports*



*The majority of voice ports are currently located outside the U.S. However, it's projected that U.S. frame relay voice ports will exceed non-U.S. ports by 2000.

Source: ATM and Frame Relay Industry Update (Vertical Systems Group)

Nevertheless, the move to T3 is only in its infancy, SBC's Fuller. "We'll be well into 1999 before we see some serious movement toward higher speeds," she says.

Revenues from T3 and fractional T3 frame relay will leap from $50.1 million this year to $304 million in 2000, and the number of ports will rise from a mere 650 to more than 3,000 by the millennium, Malone says (Figure 3).

Today, most frame relay links are 56/64 kbps lines; however, IXCs and LECs report that demand for T1 is on the rise as well.

"Demand [in BellSouth territory] for T1 frame relay is in excess of 20% of the total ports sold-up from 10% two years ago," says Bob Fulghum, project manager of fast packet services for BellSouth, which offers tariffed fractional T1 and fractional T3 frame relay at 3 Mbps and 6 Mbps on an individual case basis.

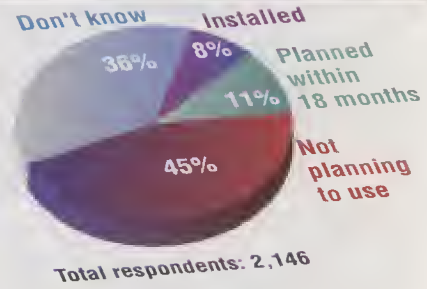
Bell Atlantic has experienced a "tremendous shift" in link size, zipping from 70% 56/64 kbps lines and 30% T1 lines at the end of 1996, to 60% 56/64 kbps lines and 40% T1 lines at present, says Stephanie Taylor, frame relay product manager for the carrier.

TALK, TALK

"We are assuming that there will be no proactive push [by any of the carriers] to get voice on frame. Only 4% of public frame relay ports were supporting voice this year and that will grow to only 8% by 2000 in the U.S.," Malone says (Figure 4).

When asked whether it planned to implement VoFR, only 11% of 2,146 end users quizzed by Vertical Systems Group for its WAN Plans '97 study said they planned to do so within 18 months (Figure 5).

Figure 5: Voice over frame relay plans



Source: WAN Plans '97 (Vertical Systems Group)

"Our customers say that they care about voice over frame relay, and we believe it will be a big hitter," US West's Hirsch says. The carrier is testing VoFR equipment and plans to support voice a VoFR service at the end of the first quarter 1998, in addition to a multipoint video service, he adds.

Carriers may want to consider offering a VoFR service, because frame relay networks may be able to provide a higher grade of service for voice than IP networks can, Azuma observes.

Ameritech already has a bundled VoFR offering and Frontier is planning one for the second half of 1998. AT&T, on the other hand, has no such plans.

"We don't get that many questions about voice over frame relay," AT&T's Daugherty says. "Voice is cheap, and you get a lot of features on voice networks with regard to billing and reports that you would not get if you were to transfer voice onto the frame relay network." ■

Notebook

ANNIE LINDSTROM

FLEXIBLE FRAME

GTE (Irving, Texas) recently introduced its FlexGrow trunk service.The next-generation integrated access service transports voice, data and fast packet services such as frame relay and Internet Protocol (IP)/Ethernet over a single 1.544 Mbps (T1) line. FlexGrow is particularly suited for small- to medium-sized businesses that have complex voice and data communications requirements and use between 40 and 200 lines.

GTE plans to launch FlexGrow in Texas first and then seek regulatory approval of the service in 10 other states.

With FlexGrow, customers can activate only the digital channels and services they need at the moment and add additional services or extra bandwidth later without changing out any equipment or interrupting their service.

For example, if a business that currently uses 10 private branch exchange (PBX) lines and one 56 kbps frame relay circuit were to suddenly see an increase in its customer base, the company immediately could add a 384 kbps fractional T1 line to support videoconferencing sessions with suppliers and add a 128 kbps frame relay circuit to transport larger amounts of data from one office to another office without having to purchase new equipment.

VIEWING CLEAR THROUGH

Intermedia Communications Inc. (ICI; Tampa, Fla.) has added end-to-end quality of service monitoring and fault management functionality to its ViewSpan frame relay management service.

ViewSpan, which was introduced by ICI in April, provides visibility across multiple Ascend-based carrier networks for a comprehensive view of interconnected carrier networks in which the ViewSpan server has been deployed.

The new capabilities allow customers to verify the performance of multiple service providers and help carriers and end users validate end-to-end service guarantees for network transit delay, committed information rate (CIR) frame delivery, discard-eligible frame delivery and permanent virtual circuit (PVC) availability.

ASCEND MAKES HEADWAY

Japan's **Nippon Telegraph and Telephone Corp. (NTT)** recently decided to install 150 of **Ascend Communications Inc.'s** (Alameda, Calif.) B-STDX 9000 multiservice frame relay switches and several of the vendor's CBX 500 asynchronous transfer mode (ATM) switches In its domestic frame relay network backbone over the next three years.

Ascend and **BellSouth** (Atlanta) revealed plans to co-market remote access systems, such as end-to-end frame relay and ATM solutions, to corporate customers and Internet service providers.

The agreement covers all of Ascend's products, including the vendor's frame relay, integrated services digital network (ISDN) and ATM offerings.

EFFICIENT ACCESS

Paradyne Corp. (Largo, Fla.) recently unveiled its FrameSaver frame relay-based Internet/intranet security and management solution.

The new capability allows end users to provision corporate Internet/intranet access via frame relay lines.

By combining Internet and intranet accesses on a single access line via two permanent virtual circuits (PVCs), users can save the access costs of a second access line and second frame relay port.

Data bursting can be shared between the two servers, which allows for lower port and committed information rates (CIRs) to be configured.

FrameSaver frame multiplexing supports prioritization of the World Wide Web, Intranet and Systems Network Architecture (SNA) traffic all sharing a single frame relay port, which ensures that critical applications get through during periods of network congestion.

TTC DEBUTS FAST INTERFACE

Telecommunications Techniques Corp. (TTC; Germantown, Md.) has added a high-speed serial interface (HSSI) to its Firebird 500 Internetwork Analyzer.

The new feature provides test access to fast packet services running at speeds of up to 52 Mbps on an HSSI.

Field technicians can use the device to troubleshoot problem installations and isolate HSSI frame relay service faults. The interface costs $6,250 and will be available next month.

SEEING FRAMES

Adtran Inc. (Huntsville, Ala.) recently unveiled its IQ Series of data service units/channel service units (DSUs/CSUs).

The service lets end users view and control the physical and logical connections in frame relay networks without the use of additional test equipment.

The DSU IQ provides frame relay access on digital data system 56/64 kbps service and the TSU IQ provides frame relay access on fractional T1 and T1 (1.544 Mbps) service.

The TSU MUX IQ module provides frame relay access on mixed-mode networks, and the IQ View provides an intuitive, graphical user interface for complete frame relay performance management.

Each permanent virtual circuit (PVC) accessed through an IQ product is managed end-to-end as if it were a leased line connection. The devices gather and store real-time statistics on throughput, bandwidth use, bursting, congestion and network delay.

The data can be used for long-term network planning and to compare actual network performance to a carrier's service level agreement.

The DSU IQ is available at a list price of $995. The TSU IQ also is available and lists for $1,845. The TSU Mux IQ module will be not be available until the first quarter of 1998 and will list for $900. IQ View is available now; pricing begins at $2,500.

INTERNET

FRANK BERNHARD

The intranet unleashed

How service providers can deliver a valuable knowledge tool to business customers.

In a furious race to seize control of the Internet, many subscribers have begun to harness a new paradigm of information management—the intranet. With an explosive growth of knowledge-based applications coupled by a relatively short development cycle, more enterprise infrastructures have begun to incorporate intranet access as a core interface to connected database systems. Indeed, today's user environment mandates the ability to control greater quantities of information—forcing connectivity issues to surface. Service providers must grapple with the understanding of tomorrow's information technology framework.

Market EngineerinG

Yet, the industrial strength of the mainframe computing environment has not swayed in light of client/server architecture and the emergence of extensive database tools in the Unix and Windows NT platforms. Moreover, the network has continued to evolve alongside these legacy powerhouses and has driven application development toward simple graphical user interface (GUI) views. Hand in hand, intranet technology satisfies the user's quest for access to host information—while establishing a portable and secure link throughout a variety of visual formats.

The rise of intranets represents an important economic principle—the implicit value of knowledge—where the power of information alters the course of business direction. Given the critical nature of data in discerning market conditions, subscribers will turn to their network service providers to furnish consultation on deployment strategies and integration of complex data structures.

A NEW NICHE

As the demand curve for intranets and virtual private networks (VPNs) climbs steeply upward, public carriers must shift toward service-related offerings that address the development and maintenance aspects of subscriber networks. Customers require skilled technical assistance to author their applications and manage the instructional training throughout their user groups. While intranets appear simplistic, few organizations realize the complexity of engineering a medium that weaves the fabric of their network systems.

Peering into the future, the greatest profit potential is in the integration and professional services domains. Historical spending records and market statistics predict a sharp expansion in consumer demand for the skills necessary to deploy and monitor intricate site developments. Labor shortages cause the price threshold to rise steadily until a point of equilibrium is reached. However, the market remains static with response to fluctuations caused by technological innovation and the convergence of varying skill sets—not to mention the external demand characteristics formed by changing customer preferences.

Application groups now focus on shared data resources—abandoning the orphan environment in exchange for a collaborative interface. As the subscriber population increases,

Table 1: Market forecast for intranet-related hardware, software and services ($-millions)	1995	1997	1999
Authoring tools & services	$9	$65	$188
Browser tools	$22	$30	$31
Connectivity services	$988	$2,634	$5,338
Network hardware	$366	$1,122	$2,456
Online services	$247	$1,123	$2,543
Retrieval tools & services	$18	$134	$280
Server hardware	$611	$1,722	$3,830
System hardware	$883	$2,855	$6,744
Totals	**$3,144**	**$9,685**	**$21,410**

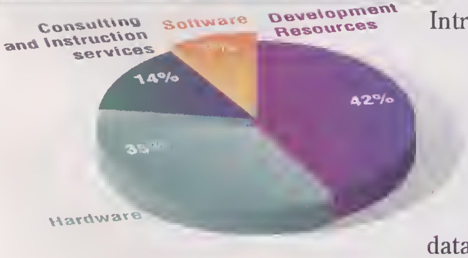
Table 2: Revenue forecast for intranet consulting and professional services ($-millions)	1997	1999
Authoring software and services	$65	$188
Content management services	$810	$2,780
Instruction and training	$1,311	$3,211
Integration services	$2,100	$6,377
Totals	**$4,286**	**$12,556**

bandwidth demand and network congestion play key parts in ensuring a sustainable quality of service. Service providers must detect the forthcoming network performance struggles as users stretch access limits.

Providers can differentiate their market position by tailoring a service offering to embrace specific needs of the intranet user. Upgraded backbones and migration to a contemporary architecture enable subscribers to recognize performance gains. With telecommuting taking shape across many organizations, performance and reliability are critical for building brand equity and customer retention.

A MEDIUM FOR KNOWLEDGE

Expenditures for intranet development



One of the great misnomers is the *value of knowledge*—and the relevant economic benefits—that causes many users to leverage intranets as a media tool. Intranets establish a controllable environment for sharing discussion records, posting secure data to authorized viewers, and interfacing with business applications. One of its strong purposes may best apply to customer retention, and the dissemination of data to attract and maintain new audiences.

Intranets let customers conduct business transactions within defined boundaries of the network—allowing access to information bases that aid in knowledge transfer. For example, long-distance subscribers may query their accounts and review additional services to purchase. Given the high cost of human resources and the even higher marginal value of a customer's time, technology contributes to increase efficiency. Customers who find heightened levels of satisfaction with these tools will mold a bias or preference for a certain provider.

Competitive intelligence is another integral part of the retention model. Perceptions of customer behavior and market trends aid organizations in shaping their product strategy to follow the customer accurately—and improve the customer service process. Several carriers have launched research initiatives via their intranets to better understand growth vehicles for specific lines of service.

VALUATION AND TREND ANALYSIS

Research reveals interesting trends. Taking a broad look at the aggregate market (firmware, applications and services), a growth curve can be safely estimated in all facets of intranet-related components—particularly in authoring tools and services (see Tables 1 and 2). The sharp increase is due to corporate application of custom tools for extending intranet capabilities. In a national survey of IT networking groups, nearly 72% expressed intent to expand their intranet projects.

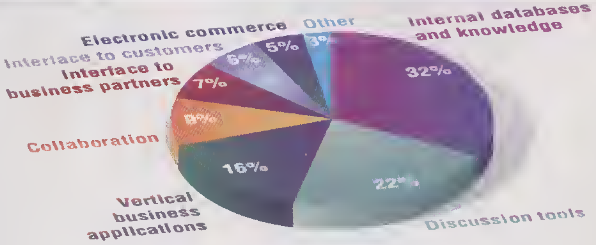
Frank Bernhard is a principal economist and market consultant in Northern California and can be reached at fbernhard-@advanstar.com

Keenly enough, connectivity services will more than double —to nearly $5.3 billion—over the next two years, and continue to soar as a result of dependency on intranet applications. As organizations migrate their vertical business applications and internal databases to intranet platforms, expenditures for networking and server firmware will spiral upward, confirming an intent to manage the enterprise at the network level.

Corporate intranet valuation and spending patterns prompts a gain in operational efficiency, most likely facilitated by imperatives to encourage remote connectivity with mainstay business data. With the unstable nature of most local area network (LAN) environments, access to corporate information systems via the Internet delivers an inherent reliability factor and assures multiple points of presence for reaching the host server.

Intranets provide efficient traffic routing and switching patterns. With improved handling of traffic through the Internet, LAN devices and infrastructure may be diverted to manage other data sources—further reducing the need for redundant firmware—and provide a significant cost savings.

Intranet applications (according to service category)



PUSH TOWARD CORPORATE INTRANET STRATEGIES

While organizations rethink their long-term IT strategies, countless numbers of intranet projects will weave the access fabric to heterogeneous systems and application tools. From Electronic Data Interchange (EDI) to beyond collaborative databases, intranets will emerge as a choice application development platform, satisfying the requisite for advanced interface to external and internal information groups.

However, service providers beware. Accelerated demand for intranet deployment may bring about unforeseen difficulty in maintaining network reliability and worsen the consequences of poor performance. On the positive side, an opportunity to deepen the levels of competitive intelligence may assist customer retention issues, allowing service providers to stay ahead of the competition.

Never underestimate the value of knowledge. As markets unfold, information becomes a scarce-but-valuable commodity, and knowledge interaction allows a wealth of benefits to impact users at all levels. ■

INTERNET Notebook

David Kopf

BellSouth.net, AT&T WorldNet rolling out 56 kbps access lines, standard or no standard

Internet service providers (ISPs) **BellSouth.net Inc.** (Atlanta) and **AT&T WorldNet Service** (Basking Ridge, N.J.) are rolling out 56 kbps access lines to their users.

BellSouth.net, which supports K56flex modems, has opened up 56 kbps access to users in Orlando and Miami, Fla.; Birmingham, Ala.; and Nashville, Tenn. BellSouth says it plans to offer K56flex access in all its markets by the end of March.

In addition, BellSouth has teamed with **Zoom Telephonics** (Boston), a maker of various fax and data modems and integrated services digital network (ISDN) terminals, which will offer BellSouth.net customers special rebates on 56K modems.

Despite the fact that 56 kbps modem technology hasn't been standardized, that Federal Communications Commission power output limitations force a 53 kbps ceiling over 56K modems, and that various network constraints can impact the actual throughput users end up with, BellSouth has, like many ISPs, adopted some form of 56 kbps modem technology to meet user demand for fast access.

"BellSouth.net service is keeping pace with technology improvements, while our customers are offered a special deal on a new modem," says Donna Lachance, BellSouth.net's vice president of consumer products. "With 56K service, we're offering very fast, reliable dial-up Internet service for quicker Web page downloads and screen refreshes. This is a very real example of how BellSouth.net service is growing with its customers' needs for the long run."

Besides using retail outlets, users can order Zoom 56K modems online via link from the BellSouth.net customer gateway. If users mail in a rebate coupon with proof of purchase of the modem, they can get $30 back if they use the gateway ($25 for retail purchase).

AT&T WorldNet has started deploying 56K access in its network, with plans to make it available to all subscribers by June. Again, user demand for faster access—proprietary or not—is cited as the central factor in offering 56 kbps access lines.

"Out customers are telling us that high-speed access is important to them," says Dan Schulman, vice president of AT&T WorldNet Service. "As the Internet becomes increasingly important to our customers, it's only natural that they should want to retrieve information more quickly."

The first 27 WorldNet 56 kbps access points will be outfitted with x2 modems from **3Com Corp.** (Santa Clara, Calif.), which will offer a $50 mail-in rebate to WorldNet subscribers who purchase 3Com x2 modems before Jan. 17.

However, because 56 kbps modem technology is not yet standardized, WorldNet also plans to support K56flex technology as well. "Our customers are frustrated by the lack of a common standard and the need to chose between two incompatible technologies—x2 and K56flex," Schulman says. "We wholeheartedly concur that everyone be best served by the rapid implementation of a common standard, and we are working with modem manufacturers to help make that happen. Until it does, we'll distribute modems with both technologies, although we will not have complete coverage for both technologies."

AT&T WorldNet will support the common standard—which will be designated V.PCM when adopted—letting subscribers to use x2 and k56flex technologies interchangeably. 3Com will offer x2 users a free upgrade to convert to the standard when it's released.

SAVVIS ranked top Internet backbone in independent study

National Internet carrier **SAVVIS Communications Corp.** (St. Louis) was ranked the fastest Internet backbone provider in an independent test of backbone providers conducted by **Keynote Systems** (San Mateo, Calif.) and *Boardwatch Magazine*.

The ranking was based on over 3.6 million performance measurements taken from vantage points in 27 cities over a six-week period in August and September. The study was the second of its kind, the first having been conducted in April/May.

Savvis had the fasted average page-download time of 4.905 seconds, more than twice as fast as the overall average and over three times faster than the five slowest backbones.The overall performance average for all measured backbones increased from 9.928 in the previous study to 10.370 seconds—a 4.5% drop in overall Internet performance. The study also showed that Web content travels, on average, at 40 kbps, lowering the typical rate that users of 56 kbps modems experience.

Top 10 Internet backbones

Backbone	Performance (In seconds)
1. SAVVIS	4.905
2. CWIX	5.008
3. CompuServe	5.664
4. UUNet	5.912
5. MCI	6.347
6. GlobalCenter	6.995
7. GTE/BBN Planet	7.491
8. ELI	7.628
9. ANS	7.689
10. DataXchange	7.756

Source: Keynote Systems

AT&T WorldNet to add 75 POPs by the end of 1997

AT&T WorldNet Service (Basking Ridge, N.J.) will add 75 points of presence (POPs) by the end of this year, pushing WorldNet's total number of POPs to 330. Each POP will provide one or more phone number to let users reach the service with a non-tolled local call.

"Customers want local access to reach AT&T WorldNet Service," says Dan Schulman, vice president of AT&T WorldNet. "This action expands our local footprint to more than 70% of the country."

The POPs are located in cities across the following states: Alabama, Arizona, California, Illinois, Indiana, Kentucky, Louisiana, Michigan, Missouri, New Mexico, North Carolina, Ohio, Oregon, Pennsylvania, Texas, Virginia, Washington, West Virginia and Wisconsin.

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18 ○ H MSO (Two or more Cable TV Systems)
19 ○ I Independent Cable TV System
20 ○ J Cable TV Contractor/Engineering Firm
21 ○ K Other Cable
22 ○ L Competitive Access Provider (CAP)
23 ○ M Telecommunications Reseller
24 ○ N Internet Service Provider/Commercial Online Service Co.
25 ○ O Systems Integration/Outsourcing
26 ○ P Other Carrier
27 ○ Q OTHER ____________ *(please specify)*

3. Which of the following describes your title classification? *(Fill in **ONE** only.)*

28 ○ 11 **Technical Mgmt.** (Engineering VP, Director or Mgr.; Technical VP, Director or Mgr.; Network VP, Director or Mgr.; Plant Mgr.)
29 ○ 12 **Engineering** (Network Designer, Engineer, Technician)
30 ○ 25 **Data Communications/Digital/IS/MIS Mgmt.** (Data Communications, Digital, I/S VP, Director or Mgr.)
31 ○ 13 **Mgmt.** (VP, General Mgr., System Mgr., Mgr., Director)
32 ○ 3 **Corporate Mgmt.** (Chairman, Owner, President, Partner, Executive/Senior VP/Director, Treasurer, CFO, COO)
33 ○ 4 **Legal, Financial, Regulatory or Processing Services** (Director or Mgr. of Rate Planning & Administration, Service Costs, Methods)
34 ○ 5 **Personnel & Administrative Services** (Director or Mgr. of Training, Safety, Security, Buildings & Land, Supplies & Distribution)
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4. Which of the follow equipment/services do you purchase, recommend, specify, approve or otherwise influence the purchase of? *(Fill in **ALL** that apply.)*

38 ○ A **Wireless/Cellular/Mobile/PCS Equip./Services**
39 ○ B **Central Office Equip./Services** (CO Switching Equip. [digital, ATM], Programmable Switches, Operations Support Systems, Workstations, CO Test, Hardware, Frames)
40 ○ C **Transmission and Broadband Distribution Equip./Services** (Digital Loop Carriers, Sonet, T1, Microwave, Satellites, Digital Cross Connects, Amplifiers, Passives, Cable, Long Haul Transmission Systems, Loop Distribution and Electronic Systems, Multiplexers)
41 ○ D **Cable/Video/Multimedia Equip./Services** (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
42 ○ E **Customer Premises, Broadband Subscriber Equip./Services** (PBXs, Station Equip., ACDs, Videoconferencing, Remote Controls, Converters)
43 ○ F **Outside Plant and Construction Equip./Services** (Pedestals, Vehicles, Towers, Tools, Enclosures)
44 ○ G **Data Communications/MIS/Network Mgmt. Support Equip./ Services** (including LANs, WANs, & Network Software)
45 ○ H **Power & Protection**
46 ○ I **Test & Measurement**
47 ○ J **Other** *(please specify)* ____________
48 ○ K None of the Above (A–J)

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Attention: James Bond wannabes

Not that anyone could *really* impersonate Pierce Brosnan a.k.a. James Bond, but listen up—it may be a little easier to follow in his footsteps.

Ericsson Mobile Telephones will award a 1998 BMW to one lucky mobile phone salesperson as part of a sweepstakes created to drive sales and excitement around Ericsson's co-promotion in *Tomorrow Never Dies*, the new Bond film due this month.

Retail sales people can enter their names in a random drawing each time they sell an Ericsson mobile phone through Feb. 14, 1998. Participants can enter by faxing an official entry form to 800/766-9149. The more Ericsson phones they sell, the greater chances are of winning. But will they be as suave as our dashing hero? Only Miss Moneypenny could be the judge.

The latest Bond film features Agent 007 relying on a variety of Ericsson phones to help him out of some difficult situations—would those be cavorting with beautiful women or deciding whether he wants his martini shaken or stirred?

labels that comprise the Windham Hill Group. Check out www.windham for more information.

WATERMARKS: NEW ONLINE COPYRIGHT PROTECTION SCHEME

A digital "watermark" for scanned photographs has been developed to stem the growing problem of copyright infringement of photos transmitted on the 'Net. The system encodes information about the owner of the image within the pixels of the photograph, invisible to the eye. When a digitally watermarked photo is downloaded, image-editing programs will automatically identify the image as having been watermarked. Even if the user ignores the copyright information in the watermark, and alters the photo, the watermark continues to transmit its copyright.

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In search of Teddy Telephone

RECALL
FROM THE AMERICA'S NETWORK ARCHIVES

Like a bottle of fine wine or a favorite dessert, some people have their druthers about company trademarks. Take for example an article appearing in the Feb. 15, 1963, issue of *Telephone Engineer & Management*. According to the story, this was a case where the public developed a definite idea about the sound of the Mankato (Minn.) Citizens Telephone Co.'s (MCT) trademark character "Teddy Telephone."

When Teddy was introduced to his public in 1922 on the radio, telephone subscribers were disappointed—and said so. Despite extensive advance searching by MCT, the voice selected to portray Teddy simply "wasn't Teddy," to the ears of his Mankato fans.

Like any beloved character, Teddy was a familiar figure in southern Minnesota areas served by MCT. He appeared on signs, trucks, direct mail and other well-observed places… he even had his own newspaper column, where he commented on everything from local events to giant steps in communications research.

When complaints about Teddy's radio voice multiplied, the vice president and the general manager of MCT had the radio spots banished. This was accompanied by a column announcement from Teddy, stating he was going to have his tonsils out.

In September 1962, MCT announced via radio some lucky little boy or girl (where was Peter Brady when you needed him?) would be selected as the 1963 radio voice of Teddy Telephone. The lucky winner turned out to be sixth grader Laura Reiland. Although Reiland had had no formal speech training, she was met by the public with open arms. But the big question was, "How do you dress a little girl to look like Teddy Telephone for the purpose of personal appearances?"(Maybe Howard Stern or Dennis Rodman could have been of some assistance.)

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Musical Artist Yanni becomes more "devoted"

Today's pre-paid phone cards are becoming another way for musical artists to promote themselves.

Cable & Wireless Inc., the nation's largest telecommunications company exclusively serving the business market and wholly-owned subsidiary of Cable and Wireless plc (NYSE: CWP), has developed a pre-paid phone card for Private Music and the Windham Hill Group featuring internationally known recording artist and Linda Evans' beau, Yanni, and his latest recording "Devotion." When using the card, the card holder will hear a message directing them to a phone number giving more information about Yanni or other Windham Hill artists and upcoming concerts. Private Music is one of four recording labels that comprise the Windham Hill Group. Check out www.windham for more information.

WATERMARKS: NEW ONLINE COPYRIGHT PROTECTION SCHEME

A digital "watermark" for scanned photographs has been developed to stem the growing problem of copyright infringement of photos transmitted on the 'Net. The system encodes information about the owner of the image within the pixels of the photograph, invisible to the eye. When a digitally watermarked photo is downloaded, image-editing programs will automatically identify the image as having been watermarked. Even if the user ignores the copyright information in the watermark, and alters the photo, the watermark continues to transmit its copyright.

Welcome to *America's Network's* **Solutions**. Our traditional product coverage has been redesigned and refocused in an effort to present the systems, equipment and services that solve networking problems and help satisfy public network provisioning and maintenance needs. In each **Solutions** section, you'll find:

- Case studies and analyses of notable equipment, systems and services;
- A special section focusing on a specific technology market, such as Broadband (page 47), Testing & Monitoring, and Power & Protection; and
- As always, our general products and services coverage.

We hope you'll find **Solutions** a useful reference tool for selecting products, systems and services. As always, we welcome your comments.—*Ed.*

Provider launches voice-over-IP with Lucent server

Transfer Technologies Inc., a prepaid calling card company, will be the first service provider to offer commercial Internet telephony based on the Internet Telephony Server (ITS), a real-time, voice- and fax-over-Internet Protocol (IP) offering from Lucent Technologies (Murray Hill, N.J.). "In the prepaid calling card business, Internet telephony is an excellent way to reduce costs," says Peter Galdi, Transfer Technologies' president.

By handling calls over the Internet rather than the PSTN, enterprises and service providers can use voice- and fax-over-IP gateways to avoid the high costs of long distance and international calling. Essentially, gateways connect to the Internet at key geographical points, where they outdial to phones within that geographical region.

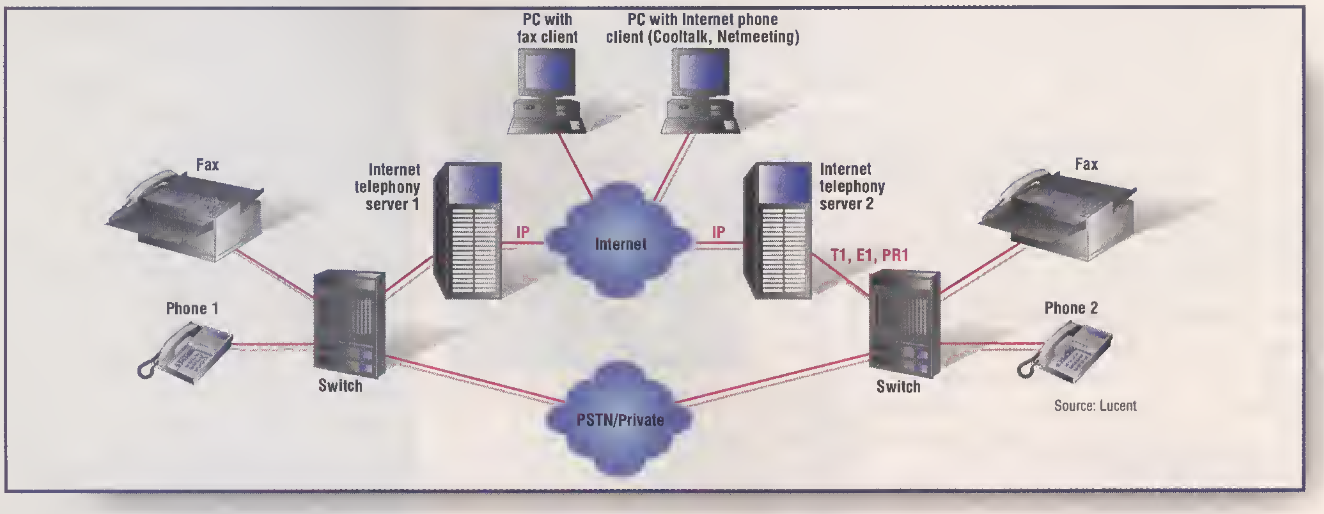
A service provider thus could offer cheap calls between Los Angeles and Hong Kong by establishing voice-over-IP gateways in both cities. Hong Kong users would dial to a gateway though the PSTN, which would connect via the Internet to the Los Angeles ITS gateway, which then would make the final connection via the PSTN to Los Angeles users (see figure).

Transfer Technologies will deploy the ITS in its Las Vegas, London and Mexico City offices, and plans to build a worldwide network encompassing dozens of gateways, Galdi says.

The ITS is based on the H.323 IP telephony standard, adopted by most voice-over-IP vendors and developers. Lucent will include standards support as well as technology that should compress voice to 10 to 12 kbps. "That's only 16% of a T1 line, leaving 84% free," says Dennis Aull, vice president of Lucent's Internet Communications.

Lucent is targeting the ITS toward enterprise networks as well. Compaq Computer Corp. will provide its ProLiant 2500 Pentium server as the first platform for the enterprise version of ITS. Lucent trialed ITS with other controlled trial customers, including a German online bookseller; KIH, a Kentucky-based service provider; and Kanematsu, a trading company with offices in the United States and Japan. MCI, ICG Communications and Aimquest are also trialing ITS.

Visit www.lucent.com/internet or circle 219.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IP
Internet telephony server 2
Fax
T1, E1, PR1
Phone 1
Switch
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Switch
Phone 2

Source: Lucent

Optical transceiver enables gigabit transmission up to 500 meters

The Fiber Channel Link compact optical transceiver provides optimal serial gigabit transmission at 1.0625 Gbps for distances up to 500 meters over inexpensive multimode fiber. Applications include implementation in data communications and telecom networks, broadband deployments, cross-connects, ATM switches, disk array links, workstation and mainframe backbones, and network interface cards.The optical transceiver complies with all current standards. The unit features an industry-standard 1x9-pin configuration, and dual optical interface. AC and DC coupled data inputs and outputs are available.

Molex Fiber Optics Inc. (Downers Grove, Ill.)

Call 800/213-3235 or Circle 217

Knowledge system for ATM network management

The NetCoach is a network management system for multivendor ATM networks, allowing organizations to improve network performance and significantly reduce network downtime.

The system addresses the operational issues of asynchronous transfer mode network management by supporting multiple vendor switches—thereby solving the common problem of how to manage a network across disparate hardware resources.

Acting as a "mentor" to the network staff, the system supports management of ATM switches from multiple vendors via a common console. By addressing the critical fault and performance management requirements of network managers, the NetCoach system helps maximize the benefits of ATM networks and protects the organization's investments in ATM technology.

The system also supports access to performance and fault information obtained from common Web browsers, enabling network managers to keep on top of network status, utilization, performance and any problems.

NetCoach is comprised of four key components, available individually or as an integrated solution:

- NetCoach Performance Manager;
- NetCoach Fault Manager;
- NetCoach Distribution Manager; and
- NetCoach Simulation Manager.

Although the system was in Beta release at press time, it was planned to be generally available by the end of 1997. Prices start at $10,000.

Stanford Telecom (Sunnyvale, Calif.)

Visit www.stelhq.com or Circle 210

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Broadband Solutions
continued

VCSEL fiber optic transceivers increase throughput

Vertical cavity surface emitting laser (VCSEL) transceivers are high- performance, optoelectronic devices allowing original equipment manufacturers (OEMs) to increase the throughput of their systems and subsystems in the backbone while maintaining low manufacturing cost.

The transceivers are the latest technological advances to achieve gigabit speeds in fiber optic systems. "High-speed serial optical interconnects for LAN backbone, high-performance workstations and telecommunications applications are of increasing interest," says Terry Unter, vice president of Global Optoelectronics at AMP Inc. "The major challenge confronting the successful development of commercial devices is low-cost, high-performance packaging. VCSEL sources and low-cost molded optics technology have enabled us to achieve these cost and performance goals."

There are three VCSEL-based multimode transceivers:

- The Gigabyte Ethernet SX Transceiver is designed for LAN routers, switches, hubs and as network interface card for high-performance servers. It uses 850 nm sources and detectors operating to data rates up to 1.25 Gbps.
- The Fiber Channel SX Transceiver is designed for use in hubs and mass storage interconnections and as a host adapter for high-performance servers. It uses 850 nm sources and detectors operating to data rates up to 1.0625 Gbps.
- The VCSEL-based 622 Mbps intermediate-range transceiver provides eletro-optic serial data transmission over a multimode fiber optic path.

All fiber optic transceivers include caps to seal the optical connector interface during soldering and cleaning.

AMP Inc. (Harrisburg, Pa.)

Visit www.amp.com/fiberoplics or Circle 207

Fiber optic troubleshooting kit

The 2854 FiberTracker troubleshooting kit provides a low-cost, non-destructive, continuity test to minimize connectivity problems for fiber-optic installations.

The test kit works with singlemode and multimode fibers, cables, splices and connectors, and can be used in outside plant, CATV, power utility, premises wiring, shipboard and laboratory applications. The kit provides clear indication of optical faults (breakpoints, microbends, bad splices, improperly installed connectors, etc.) through the jacket or buffer of most commonly used optical fiber cables. The kit is a standalone tool, but also can complement an optical time domain reflectometer in larger network applications.

Force Inc. (Christianburg, Va.)

Visit www.forceinc.com or Circle 218

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Photo:

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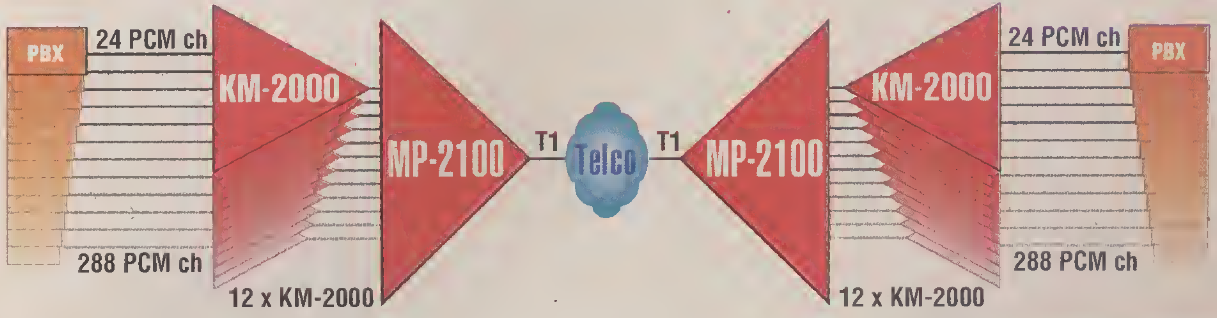

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Broadband Solutions
continued

Branch network solution

The Smartswitch 1800 is a powerful data, voice, fax and video solution in a single chassis, providing flexibility in connectivity and consolidation for data and voice telecommunications needs. The product offers transactions at close to wire speed, highly efficient throughput for LAN protocols and consistent latency in video streaming.

The product maximizes the potential of switch-based, wide-area services, such as frame relay, for multiple traffic types. It has the ability to consolidate legacy data, voice and video over a single, low-cost frame relay access link, and manages the frame relay bandwidth, providing each type of traffic with the service it needs.

Pricing for the product starts at $4,995 with one LAN port, four serial ports and two voice/fax ports.

Cabletron Systems (Rochester, N.H.)

Visit www.cabletron.com or Circle 211

Tester adds DS1 ATM analysis

The DS1 ATM testing is available as an optional feature to theT-Berd 310 Communications Analyzer. With this option, the T-Berd 310 can perform ATM analysis at transmission rates of DS1 to OC-12c.

The option provides 100% payload analysis at DS1 rates. In addition, the full suite of QoS measurements and ATM traffic-generation capabilities, already supported at DS3 rates, are supported at DS1 rates. Also supported at DS1 rates are search and preview features. The search mode isolates switches that are incorrectly provisioned, and the preview mode is used for in-service monitoring to identify potential sources of congestion.

The DS1 ATM option is bundled with the company's current DS3 option at a combined price of $3,495. The option will be available for shipping in the first quarter of 1998.

The T-Berd 310 incorporates strong physical-layer and ATM analysis. These capabilities allow for network setup and prequalification. It combines comprehensive Sonet, DS3, DS1/0, fiber optic and ATM testing in one package. The unit can be used in the central office, lab, mobile telephone switching office (MTSO) or manufacturing applications.

Telecommunications Techniques Corp. (Germantown, Md.)

Visit www.ttc.com or Circle 208

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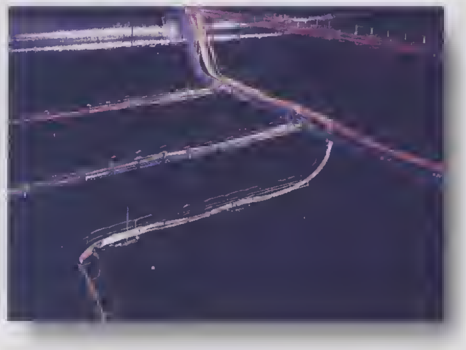
Products and Services

Plenum runs



Creating plenum runs for fragile Category 5 and fiber optic cabling places tremendous strain on management systems and their installers, according to GS Metals.

Whether it's a new or renovated office building, school or hospital, plenums are often filled with such installation pitfalls as pipes, heating, ventilating and air-conditioning (HVAC) ducts and conduit. Flextray Cable Management Systems were created to provide solid cabling support with twist-and-bend capabilities. The product also offers snip-and-bend obstacle avoidance, without the need for special parts and pieces, and enables quick installation.

GS Metals Corp. (Pinckneyville, Ill.)

Visit www.gsmetals.com or Circle 205

Acquisition and control systems

Skyline base stations and remote platforms contain intelligent, high-speed, 2-watt, synthesized, transceiver modems that have 65,000 ID codes, error detection/correction, 64 programmable RF channels and a repeater capability.

Skyline comes in UHF and VHF versions, and has its own over-the-air protocol with several options that can be configured by the user. This over-the-air protocol is transparent to the devices on either end, and is configured by hooking the Skyline to a computer through the serial port.

Skyline can be used to monitor and control physical devices through a variety of I/O modules. These modules are inside digital I/O, analog I/O and various of I/O relay configurations. Up to eight I/O modules can be connected to one remote. Skyline can also be configured to mimic an operation; for example, a relay contact closure can be sensed by a local Skyline through one of its I/O modules. This then can be transmitted to a remote Skyline unit that will provide a contact closure through its I/O module.

RF Neulink (San Diego)

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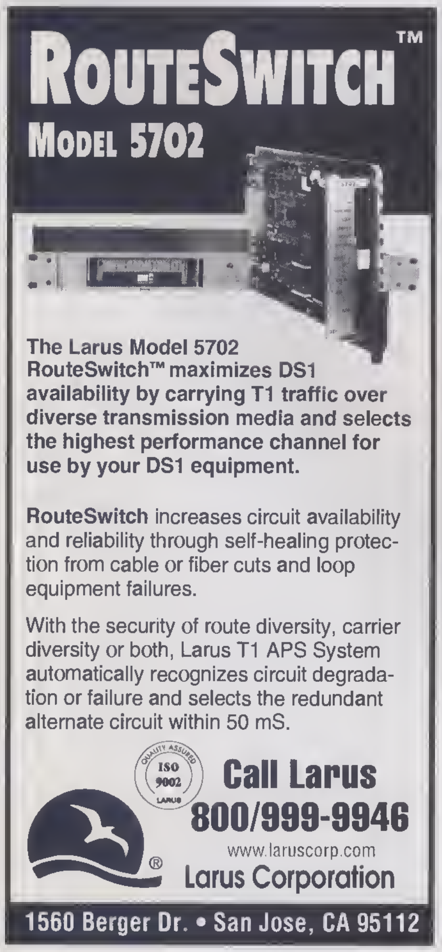

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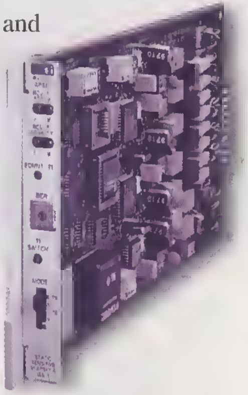
Automatic protection switch for enhanced T1



The Surepath T1 automatic protection switch circuit board meets the demand for enhanced T1 services with no downtime. The board terminates two T1 facilities for single T1 use, determines the best of two possible facilities, then connects that facility to the T1 equipment. It reportedly is the only automatic protection switch that comes on a single printed circuit board. It allows for remote and local switching and manual override controls, plus selectable bit-error-rate thresholds. Other features include:

- Separate line-buildout (LBO) controls for network and equipment terminations;
- Network-side LBO to 6,000 feet, and equipment side LBO to 655 feet;
- On-board power supply; and
- Automatic detection of alternate mark inversion (AMI).

Charles Industries Ltd. Wescom Division (Rolling Meadows, Ill.)

Visit www.charles industries.com or Circle 213

High-voltage octocouplers

The PS256X high isolation voltage octocouplers devices are available in AC and DC input configurations, single transistor, Darlington and transistor resistor versions.

The one-, two- and four-channel configurations are used for ring detection, high-frequency power supply loop feedback control, digital logic, analog signaling, and relay contact and power supply monitoring applications. The optocouplers are available in dual in-line packaging (DIP) and 2.54 mm Lead Pitch (Gullwing) packages for surface mount. They also come in miniature L1 10 mm Air Gap and L2 10 mm Air Gap surface mount packages. The octocouplers are priced from $0.20 to $0.25 each in 1,000-piece quantities.

California Eastern Laboratories (Santa Clara, Calif.)

Visit www.cel.com or Circle 204

Data circuit switches

The expansion of Dataprobe's data circuit switches offers four levels of switch automation to serve any disaster-recovery application, and provides increased manageability.

From simple, lead-activated switches for integration into remote- control systems, to fully automated line protection switching, the company support common WAN and LAN interfaces. It also provides switches in both stand-alone, single-circuit switches and high-density multicircuit configurations.

Dataprobe Inc. (Paramus, N.J.)

Visit www.dataprobe.com or Circle 201

Heat dissipaters and clips

International Electronic Research Corp's new family of heat dissipaters and clips are designed for gullwing packages that attach to plastic quad flatpacks. The one-piece design allows for easy installation and removal. The gullwing design accommodates a wide variety of packages sizes and applications can include application specific integrated circuits (ASICS), and microprocessor-based systems.

Custom-engineered heat-dissipater designs with various clip configurations are available through the company.

International Electronic Research Corp. (Burbank, Calif.)

Visit www.iercdya.com or Circle 202

Antenna coupler

To facilitate the operation of coupling mobile phones to test equipment, the Universal Antenna Coupler lets users couple all mobile telephones with these equipment.

Previously, in telephone sales and service departments, it was necessary to have a large number of different cable adapters to connect the various brands and types of mobile phones with the test equipment. Retaining an array of different cables is no longer necessary. The mobile phone is placed in the antenna coupler, which is connected to the test equipment. Cable adapters do not need to be swapped over for every different mobile phone to be treated.

All mobile phone features can be tested, including the antenna. With the cable adapter, the antenna of the mobile phone needs to be tested separately, once the cable has been removed.

Wavetek Corp. (San Diego)

Visit www.wavetek.com or Circle 214

New Product information should be submitted to Debbie Sklar, Products editor at *America's Network*
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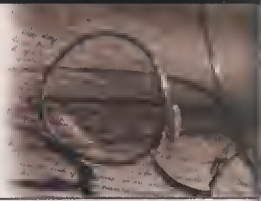

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The Spectra System multi-protocol network monitor and analyzer meets the needs of advanced SS7, PCS, GSM, IS41, X.25 and ISDN networks and laboratories. The system can monitor, test, emulate and generate SS7, ISDN and X.25 protocols simultaneously from one self-contained box. It can be carried into the field, bringing diverse protocols into a common environment for efficient, integrated troubleshooting, deployment and development. *INET Inc.*

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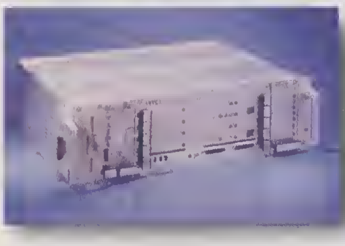

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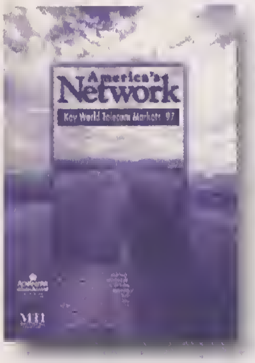

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Literature ROUNDUP

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America's Network evaluates emerging technologies for those who conceive, design, and run America's public network. From a unique business-case perspective, this twice-monthly magazine presents articles that reveal customer requirements, weighs the potential risks and rewards of a particular technology, provides practical applications, and shows specific approaches to keep a service provider competitive. For more information, call Paul Semple at 312/553-8900, or visit our Web site, www.americasnetwork.com. *Advanstar Communications Inc.*

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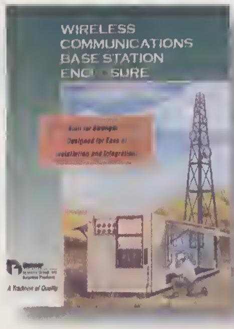

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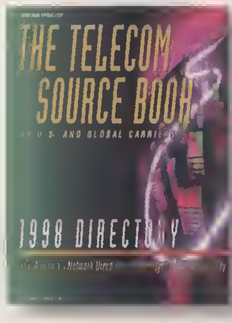

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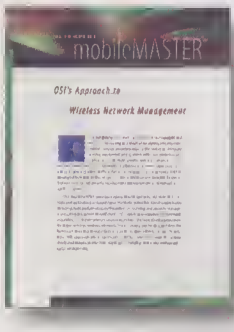

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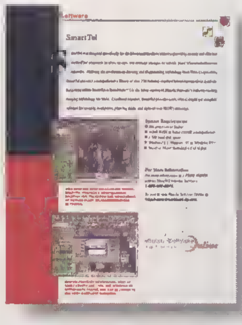

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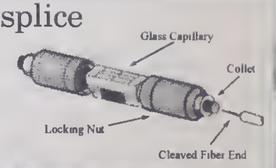

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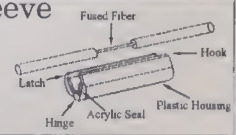

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